



# NAVAL AIR STATION FORT WORTH JRB CARSWELL FIELD TEXAS

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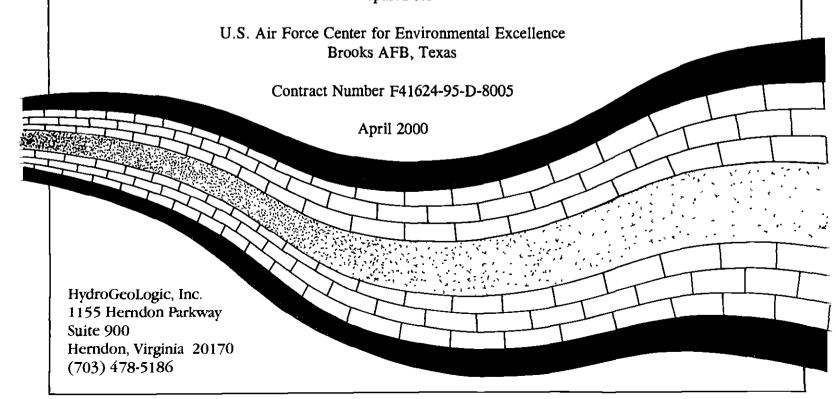
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# FINAL WORK PLANS RCRA FACILITY INVESTIGATION OF SWMUS 19, 20, 21 AND 53; AND SITE INVESTIGATION OF AOCS 17, 18, AND 19 AT NAS FORT WORTH JRB, TEXAS



Prepared for





April 28, 2000

Mr. Don Ficklen HQ AFCEE/ERD 3207 North Road, Bldg. 532 Brooks AFB, TX 78235-5363

Re: Final Work Plans

RCRA Facility Investigation of SWMUs 19, 20, 21 and 53; and Site Investigation of AOCs

17, 18, and 19 at NAS Fort Worth JRB, Texas

NAS Fort Worth JRB, Texas F41624-95-D-8005-0026/0029

Dear Mr. Ficklen:

Please find enclosed one copy of the Final Work Plan for the RCRA Facility Investigations of SWMUs 19, 20, 21 and 53; and Site Investigations of AOCs 17, 18, and 19 at NAS Fort Worth JRB, Texas Responses to the comments made by AFCEE, Unitec, and Ray Risner of the Texas Natural Resource Conservation Commission (TNRCC) have been incorporated into the document as indicated by the enclosed Responses to Comments. The field work is currently scheduled to begin on May 8<sup>th</sup>, 2000.

If you have any questions or comments, please call me at (703) 736-4518.

Sincerely,

Lynn A. Morgan, P.G.

Typ a Morgan

Project Manager

Enclosure

cc. Mr. Michael Dodyk (2 copies)

AFCEE/ERD

Building 1619, Intersection of Doolittle and Carswell Ave.

NAS Fort Worth JRB, Texas 76127

Ms Amy Hardberger (Unitec) 2100 Bypass Road Building 580 Brooks AFB, TX 78235

# FINAL WORK PLAN RCRA FACILITY INVESTIGATION OF SWMUS 19, 20, 21 AND 53; AND SITE INVESTIGATION OF AOCS 17, 18, AND 19 AT NAS FORT WORTH JRB, TEXAS



# Prepared for

U.S. Air Force Center for Environmental Excellence Brooks AFB, Texas

Contract Number F41624-95-D-8005

Prepared by

HydroGeoLogic, Inc. 1155 Herndon Parkway, Suite 900 Herndon, VA 20170

April 2000

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This document presents the Final Work Plan for the RCRA Facility Investigation of SWMUs 19, 20, 21 and 53, and the Site Investigation of AOCs 17, 18, and 19 at NAS Fort Worth JRB, Texas. The Work Plans present detailed procedures for the investigation required to evaluate the potential threat to human health and the environment posed by wastes handled at the subject sites.				
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Work Plan

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# **PREFACE**

HydroGeoLogic, Inc. (HydroGeoLogic) was contracted to perform Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFIs) at four Solid Waste Management Units (SWMUs) that require further investigation under the Installation Restoration Program (IRP) and to perform Site Investigations (SIs) at three Areas of Concern (AOCs) at the Naval Air Station (NAS) Fort Worth Joint Reserve Base (JRB) Fort Worth, Texas. Work will be conducted under Contract Number F41624-95-D-8005, Delivery Order Numbers 0026 and 0029. SWMUs requiring RFIs as part of this project include the following:

- SWMU 19 (Fire Training Area No. 2)
- SWMU 20 (Waste Fuel Storage Tank)
- SWMU 21 (Waste Oil Tank)
- SWMU 53 (Storm Water Drainage System)

AOCs requiring SIs as part of this project include:

- AOC 17 (Suspected Former Landfill)
- AOC 18 (Suspected Former Fire Training Area A)
- AOC 19 (Suspected Former Fire Training Area B)

Responsible key HydroGeoLogic personnel are as follows:

Jim Costello, P.G. Lynn Morgan, P.G. Program Manager Project Manager

This contract will be administered by the Defense Contracts Management Command, 10500 Battleview Pkwy, Suite 200, Manassas, Virginia, 22110. The Contracting Officer will be Ms. Diane C. Sharpe. The Contracting Officer's Representative (COR) will be Mr. Don Ficklen (210/536-5290), located at the U.S. Air Force Center for Environmental Excellence (AFCEE)/Environmental Restoration Division (ERD), 3207 North Road, Brooks Air Force Base (AFB), Texas 78235-5363.

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# LIST OF ACRONYMS AND ABBREVIATIONS

1,1,1-TCA 1,1,1-trichloroethane

ACC Air Combat Command

AFBCA U.S. Air Force Base Conversion Agency

AFCEE U.S. Air Force Center for Environmental Excellence

AFP-4 Air Force Plant 4

AGE aerospace ground equipment

AOC Area of Concern AOI Area of Interest

ARARs Applicable or Relevant and Appropriate Requirements

AST above ground storage tank

BDAT best demonstrated achievable technology

bgs below ground surface
BLRA baseline risk assessment
BRAC Base Realignment and Closure

BTEX benzene, toluene, ethylbenzene, and total xylenes

CAFB Carswell Air Force Base
CFR Code of Federal Regulation
cm/sec centimeters per second

CMI corrective measures implementation

CMS corrective measures study
COPC chemicals of potential concern
COR Contracting Officer's Representative

DoD Department of Defense
DPT direct push technology

DRMO Defense Reutilization and Marketing Office

EMP electromagnetic induction EMP Electromagnetic Profiling

EPA U.S. Environmental Protection Agency

ERA ecological risk assessment

ERD Environmental Restoration Division

ESE Environmental Science and Engineering Incorporated

°F degrees Fahrenheit FSP Field Sampling Plan

ft/d feet per day

FTA-02 Fire Training Area 2 GC gas chromatograph

# LIST OF ACRONYMS AND ABBREVIATIONS (continued)

gpd/ft<sup>2</sup> gallons per day per square foot

HSA hollow stem auger
HSP Health and Safety Plan
HydroGeoLogic HydroGeoLogic, Inc.

ICPES inductively coupled plasma emissions spectroscopy

ILS Instrument Landing System IRP Installation Restoration Program

IS internal standard

ITS Inchape Testing Services

JP-4 jet propulsion grade 4 fuel

JRB Joint Reserve Base

LAW Law Environmental Inc. LCS laboratory control sample

MEK methyl ethyl ketone mg/kg milligrams per kilogram mg/L milligrams per liter

MS matrix spike

MSCs medium-specific concentrations

MSD matrix spike duplicate

MSL mean sea level

NARA National Archives and Records Administration

NAS Naval Air Station

NCP National Contingency Plan

NFA no further action

NGVD National Geodetic Vertical Datum

NPDES National Pollution Discharge Elimination System

O&M operation and maintenance

OWS oil/water separator

PCB polychlorinated biphenyls

PCE tetrachloroethene

PST petroleum storage tank
PQL practical quantitation limit

PR Preliminary review

# LIST OF ACRONYMS AND ABBREVIATIONS (continued)

QA quality assurance QC quality control

QAPP Quality Assurance Project Plan

Radian Corporation

RAGS Risk Assessment Guidance for Superfund RCRA Resource Conservation and Recovery Act

RF response factor

RFI RCRA facility investigation

RI/FS remedial investigation/feasibility study

RRS risk reduction standards
RSD relative standard deviation

SAC Strategic Air Command

SI site investigation

SVOC semivolatile organic compound SWMU Solid Waste Management Unit

TAC Texas Administrative Code

TCE trichloroethylene

TPH total petroleum hydrocarbons

TNRCC Texas Natural Resource Conservation Commission

TOC total organic carbons
TOX total organic halides
TWC Texas Water Commission

USACE United States Army Corps of Engineers

USAF United States Air Force

USGS United States Geological Survey

UST underground storage tank
UTL upper tolerance limit

VES vertical electrical sounding VOC volatile organic compound VSI visual site inspection

WAA Waste Accumulation Area

WP Work Plan

# TAB

Section 1

# FINAL WORK PLANS RCRA FACILITY INVESTIGATION OF SWMUS 19, 20, 21 AND 53; AND SITE INVESTIGATION OF AOCS 17, 18, AND 19 AT NAS FORT WORTH JRB, TEXAS

# 1.0 INTRODUCTION

The following sections briefly describe the objective of the United States Air Force (USAF) Installation Restoration Program (IRP) and the rationale for implementing this work plan (WP).

### 1.1 BACKGROUND

Carswell Air Force Base (CAFB) was officially closed on September 30, 1993. A parcel of the former base now known as Naval Air Station (NAS) Fort Worth Joint Reserve Base (JRB), has been transferred from USAF to U.S. Navy management. Before complete property transfer can be accomplished, required environmental investigations of potential contamination related to Air Force activities occurring prior to Sept 30, 1993 at the NAS Fort Worth JRB property are to be complete, and contaminated sites are to be remediated.

On February 7, 1991, the former CAFB (NAS Fort Worth JRB), was issued a Resource Conservation and Recovery Act (RCRA) hazardous waste permit (HW-50289) by the Texas Natural Resource Conservation Commission (TNRCC). This permit requires a RCRA facility investigation (RFI) of all Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) listed in Permit Provision VIII, as well as those SWMUs and AOCs subsequently added to the list, in order to determine whether any of the hazardous constituents listed in 40 Code of Federal Regulation (CFR) Part 264, Appendix IX, have been released into the environment.

SWMUs 19, 20, 21, and 53 are the subject of this RFI. SWMUs 19, 20, and 21 were listed in the permit HW-50289 and SWMU 53 was listed in a TNRCC letter dated March 2, 1995 to the U.S. Air Force Base Conversion Agency (AFBCA), for inclusion into the permit requirement for Corrective Action. These two documents are included as Appendix A.

Although SWMUs 49 and 50 (Aircraft Washing Area No.1 and No. 2) were initially to be included in the WP under this RFI (per the scope of work dated May 7, 1999), future activities at these sites will be addressed at a later date in separate Technical Memorandums.

In addition to the RFI, site investigations (SIs) will be conducted at AOCs 17, 18, and 19. Although not listed in the TNRCC Permit or associated letters, investigations of these sites were requested by the Air Force after they were identified by HydroGeoLogic in February 1998 as AOCs (HydroGeoLogic, 1998a). The initial letter documenting these sites is included in Appendix A.

This investigation will be managed by the USAF under the Environmental Restoration Account. Other portions of the former CAFB that are not being transferred to the Navy remain under Base Realignment and Closure (BRAC) funding and management.

The primary regulatory programs that govern the RFI, SI, and potential closure of these sites are RCRA and the TNRCC Risk Reduction Standards (RRS) Program. The TNRCC is the lead regulatory agency for activities to be conducted at the subject sites.

The RFI and SI have been designed to meet the requirements of Permit Provision VIII of the NAS Fort Worth JRB HW-50289 permit. This WP has been prepared using guidance documents from the IRP, U.S. Environmental Protection Agency (EPA), TNRCC RRS Program, and RCRA. The WP for this project consists of the following documents:

The WP, which describes the work to be performed, explains project objectives and presents the rationale for conducting specific project activities. The WP describes the site history and setting and provides a summary of environmental investigations that have been completed at the base. A description of each SWMU and AOC is presented, along with data needs and the proposed sampling program for each site. Technical reports and presentation formats are also discussed in the WP.

The Field Sampling Plan (FSP) describes the planned field sampling procedures. Each method to be used is described in detail, including mobilization activities, environmental sampling procedures, and a field quality control program.

The Health and Safety Plan (HSP) provides guidance and procedures to satisfy health and safety regulations and procedures. The HSP describes required monitoring procedures, personal Medical surveillance procedures, site control, and protection, and site safety protocols. emergency response procedures are also described. In addition, potential health and safety risks for the investigation are identified.

#### HISTORY OF PAST IRP WORK AT THE INSTALLATION 1.2

This section describes the location, physical setting, operational history, and previous environmental investigations at the NAS Fort Worth JRB.

# 1.2.1 Installation Description

NAS Fort Worth JRB is located on 2,555 acres of land in Tarrant County, Texas, 8 miles west of downtown Fort Worth (Figure 1.1). It consists of the main base and two noncontiguous parcels (the Instrument Landing System [ILS] marker beacon and the Weapons Storage Area) located west of the city of White Settlement. The main base comprises 2,264 acres and is bordered by Lake Worth to the north; the West Fork of the Trinity River, the city of River Oaks, and the city of Westworth Village to the east; other urban areas of Fort Worth to the northeast and southeast; the city of White Settlement to the west and southwest; and Air Force Plant 4 (AFP-4) to the west. The area surrounding NAS Fort Worth JRB that is not used for Department of Defense (DoD)

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operations is mostly suburban. Land use in the immediate vicinity of the base is industrial, commercial, residential, and recreational (A.T. Kearney, 1989).

## 1.2.2 Installation History and Present Mission

Prior to the initial base construction in 1941, the area that is now occupied by the NAS Fort Worth JRB consisted of woods and pasture in an area called White Settlement. The NAS Fort Worth JRB started as a modest dirt runway built to service the aircraft manufacturing plant formerly located at AFP-4's current location. Figure 1.2 presents the geographic relationship between AFP-4 and the NAS Fort Worth JRB. In August 1942, the base was opened as Tarrant Field Airdrome and was used to train pilots to fly B-24 bombers under the jurisdiction of the Gulf Coast Army Air Field Training Command. In May 1943, the field was re-designated as Fort Worth Army Air Field with continued use as a training facility for pilots. The Strategic Air Command (SAC) assumed control of the installation in 1946, and the base served as the headquarters for the Eighth Air Force. It was renamed Carswell Air Force Base in 1948, and the 7th Bomber Wing became the base host unit. The Headquarters 19th Air Division was relocated to CAFB in 1951, where it remained until September 1988 (A.T. Kearney, 1989).

The SAC mission remained at CAFB until 1992, when the Air Combat Command (ACC) assumed control of the base upon disestablishment of SAC. In October 1994, the U.S. Navy assumed responsibility for much of the facility, and its name was changed from CAFB to NAS Fort Worth JRB. The NAS Dallas and elements of Glenview and Memphis NASs were combined and joined to NAS Fort Worth JRB to streamline naval operations into one central area. The principal activities on the base have been maintaining and servicing bombers, fuel tankers, and fighter jet aircraft (A.T. Kearney, 1989).

# 1.2.3 Site Operational History

A summary of past and current industrial activities and waste disposal operations conducted at the NAS Fort Worth JRB is presented in the following sections.

### 1.2.3.1 Industrial Activities

Major industrial operations that have been performed at the NAS Fort Worth JRB include the following: maintenance of jet engines, aerospace ground equipment (AGE), fuel systems, weapons systems, pneudraulic systems, and general and special purpose vehicles; aircraft corrosion control; and non-destructive inspection activities. Most of the liquid wastes that have been generated by industrial operations can be characterized as waste oils, recoverable fuels, spent solvents, and spent cleaners (CH2M HILL, 1984).

Waste oils generally refer to lubricating fluids/oils and, to a lesser extent, hydraulic fluids. Recoverable fuels refer to fuels drained from aircraft tanks and other base vehicles, such as jet propulsion grade 4 fuel (JP-4) and unleaded gasoline. Spent solvents and cleaners refer to stripping liquids used for degreasing and cleaning of the following: aircraft, aircraft systems and parts, electronic components, and vehicles. Spent solvents and cleaners include PD-680 (petroleum naphtha) and various chlorinated organic compounds. Specific types of degreasing solvents used by the USAF have changed over the years. Carbon tetrachloride was commonly used in the 1950s until it was replaced by trichloroethylene (TCE) around 1960. Since then, TCE and 1,1,1-trichloroethane (1,1,1-TCA) have been used, although TCE usage has decreased in favor of 1,1,1-TCA. Today, PD-680 (Type II), 1,1,1-TCA, and to a limited extent, TCE are used. Waste paint solvents and strippers are also generated on-site from corrosion control activities. Typical paint solvents include the following compounds: isobutyl acetate, toluene, methyl ethyl ketone (MEK), isopropanol, naphtha, and xylene. Paint strippers generally contain such compounds as methylene chloride, toluene, ammonium hydroxide, and phenolics. Servicing and maintaining the engines and equipment of the B-52 and KC-135 aircraft generated the majority of waste liquids at NAS Forth Worth JRB (CH2M HILL, 1984).

# 1.2.3.2 Waste Disposal Operations

Wastes have been generated and disposed of at the NAS Fort Worth JRB since the beginning of industrial operations in 1942. Historical waste management practices at the NAS Fort Worth JRB were presented in the Phase I Initial Assessment Report (CH2M HILL, 1984), the Phase I Remedial Investigation Report (Radian Corporation [Radian], 1989), and the Site Characterization Summary Informal Technical Information Report (CH2M HILL, 1996a), and are summarized in the following paragraphs:

1942-1970:

The majority of waste oils, recovered fuels, spent solvents, and cleaners were burned at the fire department training areas during practice exercises. Some waste oils and spent solvents were disposed of through contractor removal, while some waste paints (contaminated with thinners and solvents), waste oils, and PD-680 are suspected of having been disposed of in the base landfills. Some waste oils, recovered fuels, spent solvents, and cleaners were also discharged to sanitary and storm sewers. These discharges occurred primarily at the washracks. In 1955, an oil/water separator (OWS) (Facility 1190) was installed to recover waste materials discharged from the washracks. Non-aqueous materials from OWSs were pumped out and disposed of through contractor removal. Aqueous discharge from OWSs was, and still is, pumped into the sanitary sewers.

1971-1975:

During this period, most waste oils, spent solvents, and cleaners were disposed of by contractor removal. A private contractor would pump the materials from OWSs, 55-gallon drums, and bowsers. Recovered JP-4 continued to be stored at the fire training areas and burned in practice exercises. Recovered JP-4 was also reused in AGE operations. Some waste paints (contaminated with thinners and solvents), waste oils, and PD-680 are suspected of having been disposed of in the base landfills. Some waste oils, solvents, and cleaners were discharged into sanitary sewer drains, primarily at the washracks that discharge to the Facility 1190 OWS. This OWS was routinely pumped out by a private contractor, and the recovered materials were removed from the base by the contractor.

1976-1982:

The majority of waste oils, spent solvents, and cleaners were disposed of through services contracted either directly or through the Defense Reutilization and Marketing Office (DRMO). Recovered JP-4 was stored at the fire department training areas and burned during practice exercises. Recovered JP-4 was also used in AGE operations. PD-680 used at the washracks was discharged to the Facility 1190 OWS, which discharged to the sanitary sewers.

1983-Present:

Waste oils, solvents, and cleaners are collected in 55-gallon drums and temporarily (less than 90 days) stored at 12 hazardous waste accumulation points located throughout the base. They are subsequently disposed of by contractor removal through DRMO. Recovered JP-4 and other fuels (mogas and unleaded gasoline) are stored at the fire department training area for subsequent burning in practice exercises or reuse in AGE operations. Waste paint solvents or thinners and strippers such as toluene, isobutyl acetate, MEK, isopropanol, naphtha, and xylene are also temporarily stored prior to removal. Removal of waste oils and PD-680 (Type II) from OWSs is also handled by off-base contractors through DRMO.

### 1.3 SITE IDENTIFICATION AND DESCRIPTION

The areas of interest (AOIs) for this RFI are four SWMUs. These SWMUs are identified as follows:

- SWMU 19 (Fire Training Area No. 2)
- SWMU 20 (Waste Fuel Storage Tank)
- SWMU 21 (Waste Oil Tank)
- SWMU 53 (Storm Water Drainage System)

The AOIs for this SI are three AOCs. These AOCs are identified as follows:

- AQC 17 (Suspected Former Landfill)
- AOC 18 (Suspected Former Fire Training Area A)
- AOC 19 (Suspected Former Fire Training Area B)

The locations of these AOIs on the base are presented on Figure 1.3. Table 1.1 provides a summary description of each area and lists the current status of each site.

### 1.3.1 Description of SWMUs 19, 20, and 21

SWMU 19, the Fire Training Area No. 2 (FTA-2), SWMU 20, the Waste Fuel Storage Tank, and SWMU 21, the Waste Oil Tank, were located between the north-south taxiway and the former radar facility at Landfill No. 4. As these sites are related, they will be addressed as a single unit for the purposes of this investigation.

SWMU 19 was used as a fire training area from 1963 until approximately 1993 by the base fire department to simulate aircraft fires for training exercises. SWMU 19 consisted of a circular,

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gravel-lined pit with inner and outer earthen berms made of clayey soil around its perimeter (A.T. Kearney, 1989). The outer berm measured approximately 2 feet high, 260 feet in diameter, and encompassed an area measuring approximately 1.2 acres. A drainage pipe was located on the northeast side of the outer bermed area. Drainage from this pipe was controlled by a manual valve. The inner berm measured approximately 2 feet high, 120 feet in diameter, and encompassed a total area of approximately 0.25 acre (Dames & Moore, 1995). The area within the inner berm contained a gravel pit where 25-30 steel dumpsters were arranged in the shape of an aircraft. Periodically, the dumpsters were filled with oil and fuel wastes fed from two storage tanks (SWMUs 20 and 21) and ignited during fire training exercises to simulate an aircraft fire (Law Environmental Inc. [Law], 1996). In addition to the two bermed areas, a pit was reported to have existed at SWMU 19 which collected runoff from the bermed areas. This pit was eventually filled with sediment over time. The location and the time the pit existed is unknown (Radian, 1989).

SWMU 20 was an 8,500-gallon concrete above ground storage tank (AST) located approximately 50 feet from the southwest side of SWMU 19 and approximately 400 feet from a tributary of Farmers Branch Creek. SWMU 20 stored flammable liquid wastes including JP-4, waste oils, kerosene and possibly solvents for use during fire training exercises. The liquid wastes were delivered from SWMU 20 to the dumpsters located within the inner bermed area of SWMU 19 by an aboveground pump and pipe system (A.T. Kearney, 1989). The dumpsters, AST and associated piping were removed from the site in 1993 (Dames & Moore, 1995).

SWMU 21 consisted of a 12,000-gallon<sup>1</sup> underground storage tank (UST) that was used to store waste oils and solvents from the flightline industrial shops, for eventual use at the inner bermed area of SWMU 19 during training exercises. SWMU 21 was reported to have been installed in 1963 and removed prior to 1993. According to a Liquid Fuel Systems map from 1986, SWMU 21 is located approximately 50 feet from the western side of SWMU 19 and 300 feet from a tributary of Farmers Branch (Department of the Air Force, 1986). Although SWMU 21 was reported to have been removed, no documentation is available (Dames & Moore, 1995).

SWMUs 19 and 20 were removed from service in 1993. During the removal effort the top three feet of soil was excavated from the bermed area of FTA-2, and was bioremediated in a biocell. A compacted clay liner was then placed in the bottom of the excavation and the bioremediated soil was returned to the surface. The filled area was contoured to facilitate runoff of rainwater, and the site was seeded with grass to prevent erosion (Dames & Moore, 1995). A summary of the remedial effort at SWMUs 19 and 20 is presented in Section 3.5.1.1.5. Past and current photographs of SWMUs 19 and 20 are presented as Figures 1.4 and 1.5 respectively. Although there were no previous photographs taken of SWMU 21, the current photographs presented in Figures 1.4 and 1.5 represent the general area in which the UST existed.

<sup>&</sup>lt;sup>1</sup> The UST was described as a 9,500-gallon tank in A.T. Kearney's 1989 Facility Investigation.

# 1.3.2 Description of SWMU 53

SWMU 53, the Storm Water Drainage System, begins east of Haile Drive on the north side of the Building 1190 OWS (SWMU 52), and continues to the southeast through the POL Tank Farm (SWMU 68), to where it eventually ends at the intersection of Hercules and Desert Storm Roads. SWMU 53 formerly consisted of an unlined ditch from its point of origin to the point where it intersected the POL Tank Farm. At the POL Tank Farm SWMU 53 became a concrete-lined channel (CH2M Hill, 1984).

SWMU 53 currently receives waste water discharge from the Building 1190 OWS (SWMU 52). Discharge from SWMU 52 includes waste water from Hangar 1048 which houses the fuel systems shop. Discharges from the fuel systems shop consists of waste JP-4. SWMU 53 also receives storm water runoff from the flightline and hangar areas, and the POL tank farm. Storm water runoff from these areas may include traces of fuels, oils, pesticides, and solvents used on base (A.T. Kearney, 1989).

Historically, discharges to SWMU 53 included washrack wastes from SWMUs 49 and 50 (former Aircraft Wash Area No. 1 and No. 2) which contained traces of fuels, oils, solvents, and soaps. From approximately 1979 to 1984, the pipe leading from the fuel systems shop to the Building 1190 OWS was ruptured, allowing JP-4 and washrack wastes to flow directly into SWMU 53 (CH2M Hill, 1984). SMWU 53 also received storm water runoff from the Building 1190 storage shed (AOC 15), and the central waste storage area (SWMU 51)<sup>2</sup>. Waste stored at AOC 15 included PD-680 and xylene. Waste stored at SWMU 51 included unspecified quantities of various wastes produced from all industrial activities conducted throughout the base. Both AOC 15 and SWMU 51 no longer serve as waste accumulation areas (WAAs).

SWMU 53 is suspected to have existed since maintenance operations began at the facility in 1942. In 1993, approximately 700 cubic yards of soil was removed from the culvert, and a concrete liner was installed along the entire length of the SWMU (CH2M Hill, 1996a). SWMU 53 is currently operational. Past and current photographs of SWMU 53 are presented in Figure 1.6.

# 1.3.3 Description of AOC 17

AOC 17 is a suspected former landfill that extends from the west side of Building 1840, along the southwest side of Building 1820, to where it eventually ends north of Building 1803. This site was identified on aerial photographs of NAS Fort Worth JRB during the period of April 10, 1942 through April 4, 1944 (National Archives and Records Administration [NARA], 1942, 1944). During the time of operation, AOC 17 was located just west of the most western section of the West Fork Trinity River (prior to rerouting the river). Figure 1.7 illustrates an aerial photo identifying the suspected landfill overlain on a current site map.

The operational history of AOC 17 is unknown. However, if a landfill operated at the site during the early 1940s, it may have received construction debris, waste paints contaminated with thinners

<sup>&</sup>lt;sup>2</sup> AOC 13 and SWMU 51 are currently being investigated in accordance with the Revised Final Work Plans, RCRA Facility Investigation of Waste Accumulation Areas (WAAs), HydroGeoLogic, 1999.

and solvents, waste oils, and PD-680 as discussed earlier in Section 1.2.3.2, Waste Disposal Operations.

Currently, the surface of AOC 17 is covered partially by grass and partially by the parking lot along the southwest side of Building 1820. Current photographs of AOC 17 are presented in Figure 1.8.

# 1.3.4 Description of AOC 18

AOC 18 (Suspected Former Fire Training Area A) is located east of Building 1101, just north of Phillips Circle and south of Hobby Shop Road. This site was identified on aerial photographs of NAS Fort Worth JRB during the period of December 31, 1950 through January 4, 1953 (NARA, 1950, 1953). Figure 1.9 illustrates an aerial photo identifying the suspected fire training area overlain on a current site map.

The operational history of AOC 18 is unknown. However, as the site was suspected to have been operated as a fire training area during the 1950's and early 1960's, wastes received may have consisted of various waste oils, recovered fuels, and spent solvents and cleaners as discussed earlier in Section 1.2.3.2, Waste Disposal Operations.

Currently, the location of AOC 18 is covered partially by Building 1067 and a variety of sheds, partially by an asphalt parking lot, and partially by grass. According to Chief Pheiffer of the U.S. Navy, the site is currently used as a parking lot for transient aircraft refueling trucks. Trucks containing jet fuel, gasoline, and diesel fuels are parked onsite. The parking area slopes towards a bermed containment area to the east. No spills have been recorded to date. Current photographs of AOC 18 are presented in Figure 1.10.

# 1.3.5 Description of AOC 19

AOC 19 (Suspected Former Fire Training Area B) is located south of taxiway Charlie, west of Landfill No. 8 (SWMU 25), and north of Farmers Branch Creek. This site was identified on aerial photographs of NAS Fort Worth JRB during the period of February 3, 1954 through August 22, 1962 (U.S. Geological Survey [USGS], 1954; NARA, 1962). Figure 1.11 illustrates an aerial photo identifying the suspected fire training area overlain on a current site map.

The operational history of AOC 19 is unknown. However, as the site was suspected to have operated as a fire training area during the 1950's and early 1960's, wastes received may have consisted of various waste oils, recovered fuels, and spent solvents and cleaners as discussed earlier in Section 1.2.3.2, Waste Disposal Operations.

Currently, the location of AOC 19 is covered by grass. Current photographs of AOC 19 are presented in Figure 1.12.

## 1.4 REGULATORY BACKGROUND INFORMATION

This RFI is being conducted at the NAS Fort Worth JRB to satisfy RCRA requirements for federal facilities and also to comply with Provision VIII of Permit HW-50289. This permit was issued by the TNRCC on February 7, 1991. SWMUs 19, 20, and 21 were listed in the permit HW-50289 and SWMU 53 was listed in the TNRCC letter dated March 2, 1995 to the U.S. AFBCA, for inclusion into the permit requirement for Corrective Action. These two documents are included as Appendix A. An SI will be conducted at AOCs 17, 18, and 19 in order to determine the future status of each AOC under the NAS Fort Worth JRB IRP. For completeness, AOCs 17, 18, and 19, although not included in the TNRCC Permit or associated letters, will be investigated under the same requirements.

### 1.5 DESCRIPTION OF CURRENT STUDY

An RFI will be conducted at SWMUs 19, 20, 21 and 53 at NAS Fort Worth JRB in an effort to characterize previously identified hazardous chemical wastes related to past site operations. The results of this RFI may support a determination for no further action (NFA), or provide the required information to support the selection of appropriate corrective measures under the TNRCC RRS Program. The results of previous investigations, and the results of the investigation outlined in this WP will be used to determine which RRS is appropriate for closure at each of the subject SWMUs. If the RRS2 medium-specific concentrations (MSCs) are exceeded during this investigation, then (1) interim corrective measures to achieve RRS2 levels may be performed, or (2) closure under RRS3, including initiation of a Baseline Risk Assessment (BLRA), Corrective Measures Study (CMS), and corrective actions, will be performed as necessary.

An SI will be conducted at AOCs 17, 18, and 19 in order to confirm or deny the presence of hazardous chemical wastes related to past USAF activities at each site. The results of the SI will determine the future status of each AOC under the NAS Fort Worth JRB IRP.

An initial assessment will be conducted at each SWMU and AOC, focusing on characterizing any potential contaminant sources and providing a preliminary evaluation of the nature and extent of any contamination detected. For the purpose of determining if site closure can occur under RRS1, investigative sample results for inorganic compounds will be compared to established basewide background values, and investigative sample results for organic compounds will be compared to analytical method practical quantitation limits (PQLs). The results of the investigations proposed in the WP may not provide a complete delineation of the nature and extent of the contamination present at each of the subject sites. If further delineation of contamination is required at any of the SWMUs or AOCs in this study, additional monitoring wells and/or soil borings will be installed to complete characterization of the contaminants. When delineation of the contamination is complete at each of the sites, the data will be compiled and presented in an RFI Report with a discussion of the RRS standard that is appropriate for closure at each SWMU, and an SI Report with a discussion of the RRS standard that is appropriate for closure at each AOC.

### 1.6 PROJECT OBJECTIVES

The overall objective of this project is to obtain closure of the subject SWMUs, and confirm the presence or absence of contamination at the AOCs under the TNRCC RRS program. An overview of the RRS program is presented in Section 4.1 of the WP. In addition, the SWMUs at NAS Fort Worth JRB are subject to the specific requirements of the TNRCC HW Permit number HW-50289. Specific permit requirements are discussed in greater detail in Section 3.2 of the WP.

In order to obtain closure of the subject SWMUs and AOCs, each site will be evaluated during this investigation in order to determine if hazardous constituents have been released into the environment. The primary objectives for this project are as follows:

- Determine if a release from the units has occurred.
- If contamination is detected, characterize the nature and extent of the contamination.
- Determine the appropriate RRS to be used for closure of each site.

These primary objectives are discussed in greater detail in Section 3.4 of the WP.

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Tables

# Table 1.1 Current SWMU and AOC Summary Table NAS Fort Worth JRB, Texas

SWMU/ AOC	Description	Waste Managed	Operational Period	Status
SWMU 19	Fire Training Area No. 2	Waste oils, recovered fuels, spent solvents and cleaners	1963-1993	Dumpsters removed from the inner bermed area in 1993. Site no longer in use.
SWMU 20	8,500-Gallon AST	Waste fuels and possibly solvents	1963-1993	AST and associated piping removed in 1993. Site no longer in use.
SWMU 21	12,000-Gallon UST	Waste oils and solvents	1963-1993	UST reported to have been removed prior to 1993. Site no longer in use.
SWMU 53	Storm Water Drainage System	JP-4, solvents, waste water, aircraft soaps	Approx. 1942- Present	Approx. 700 cubic feet of soil removed from the drainage ditch in 1993. Concrete liner installed along the entire length of the SWMU.
AOC 17	Suspected Landfill Location	Construction debris, waste paints, waste thinners, solvents, waste oils, and PD-680*	1942-1944	Suspected former landfill filled in and covered by an asphalt parking lot.
AOC 18	Suspected Fire Training Area A	Waste oils, recovered fuels, spent solvents and cleaners*	1950-1953	Suspected former fire training area covered with an asphalt parking lot.
AOC 19	Suspected Fire Training Area B	Waste oils, recovered fuels, spent solvents and cleaners*	1954-1962	Suspected former fire training area filled in and covered with vegetation.

\*Note:

The actual waste handled at these sites is unknown. The wastes reported in Table 1.1 are based on the general disposal practices of the former CAFB during the time the site was in operation.

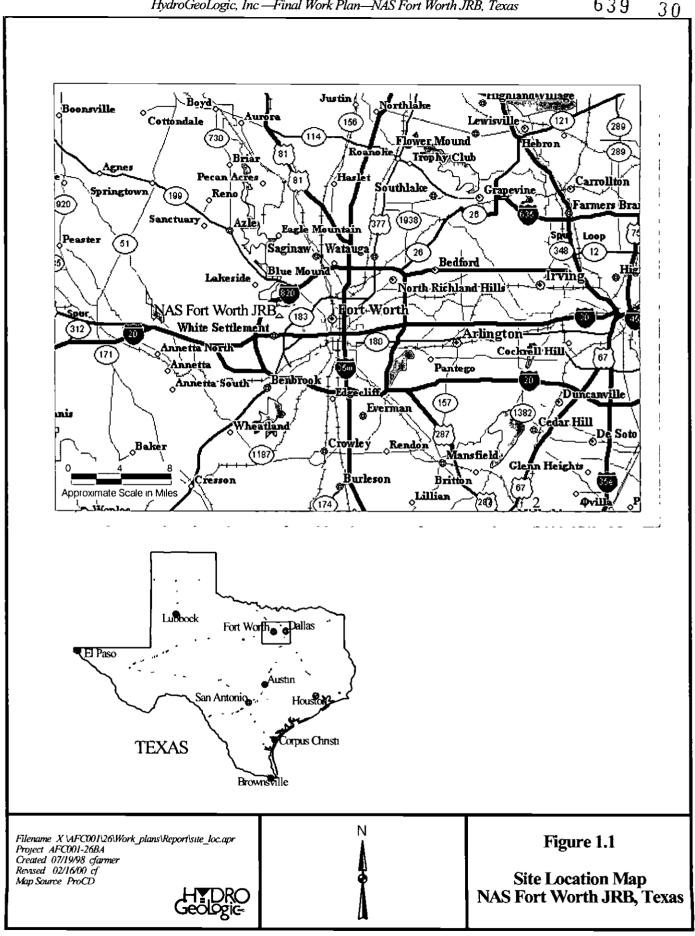
Sources:

A.T. Kearney 1989, RCRA Facility Assessment, PR/VSI Report, Carswell Air Force Base, Fort Worth, Texas

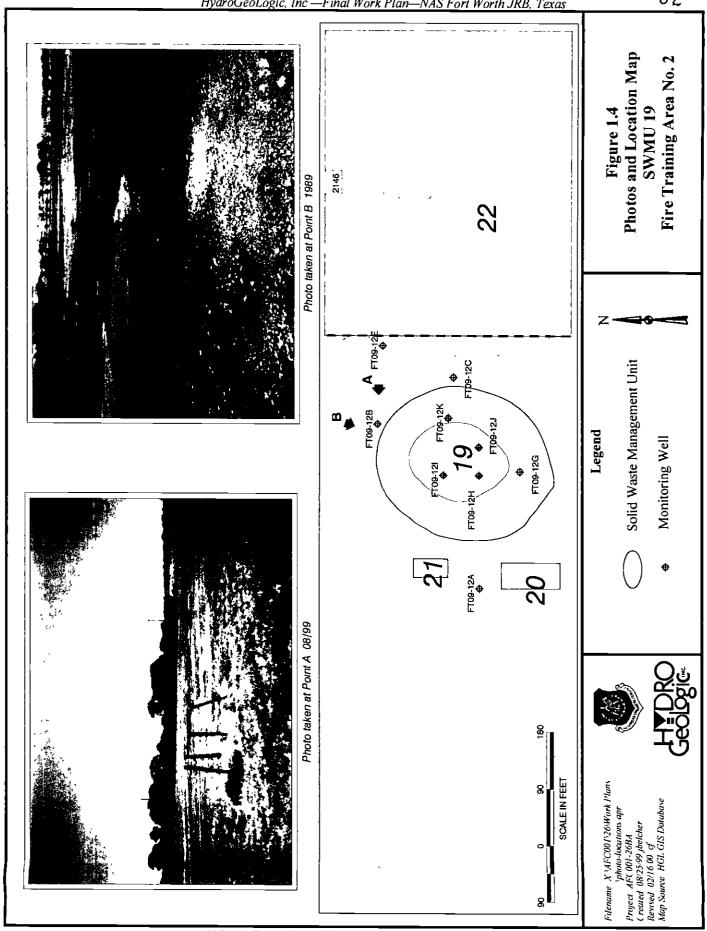
CH2M HILL, 1984, Installation Restoration Program Records Search for Carswell Air Force Base, Texas

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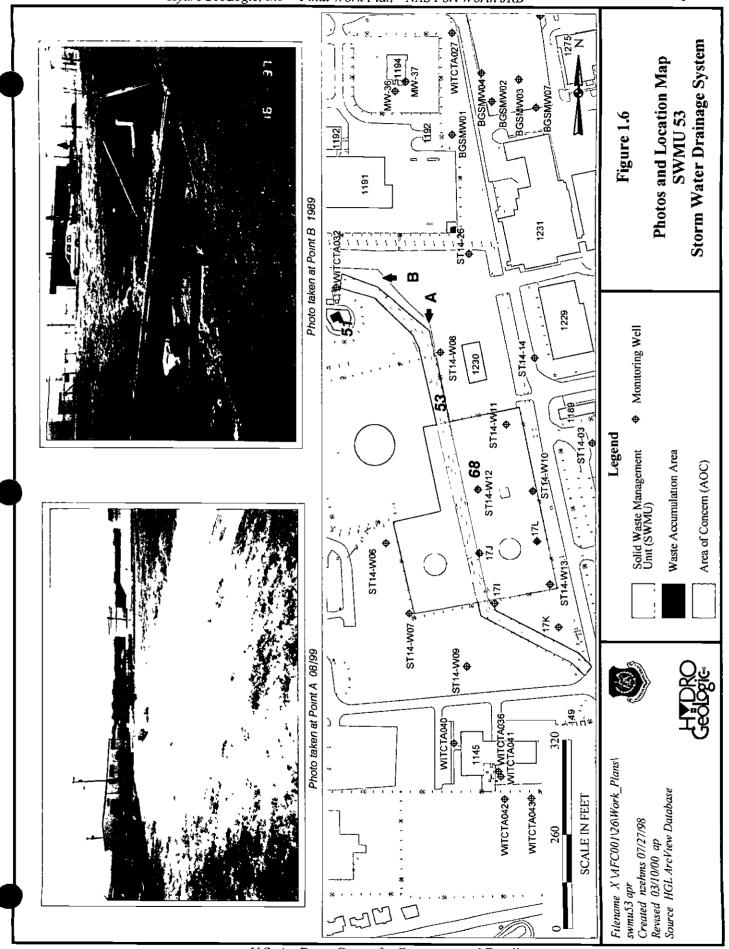
Figures



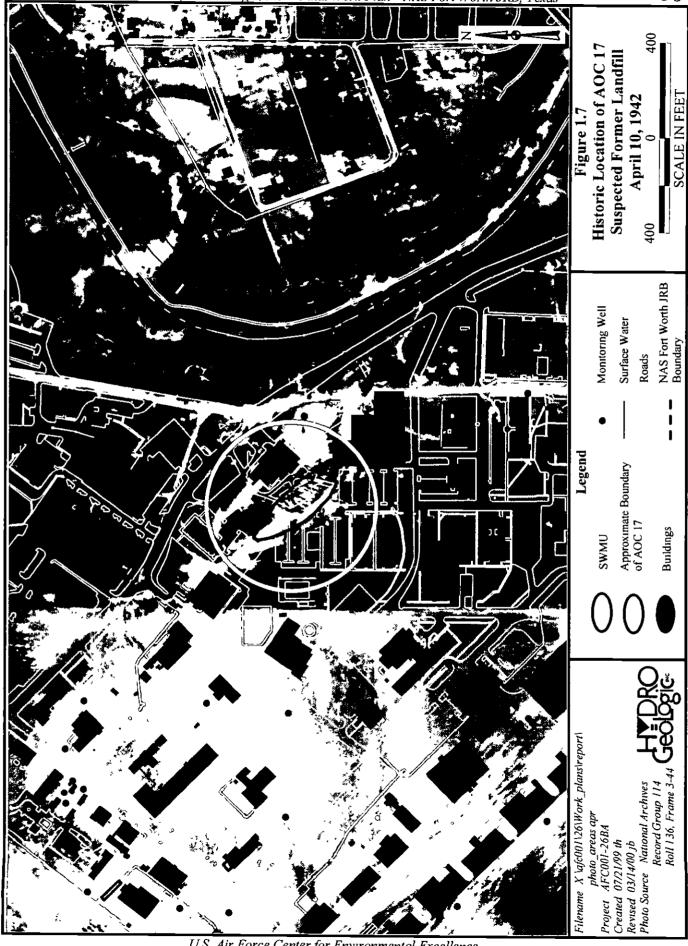
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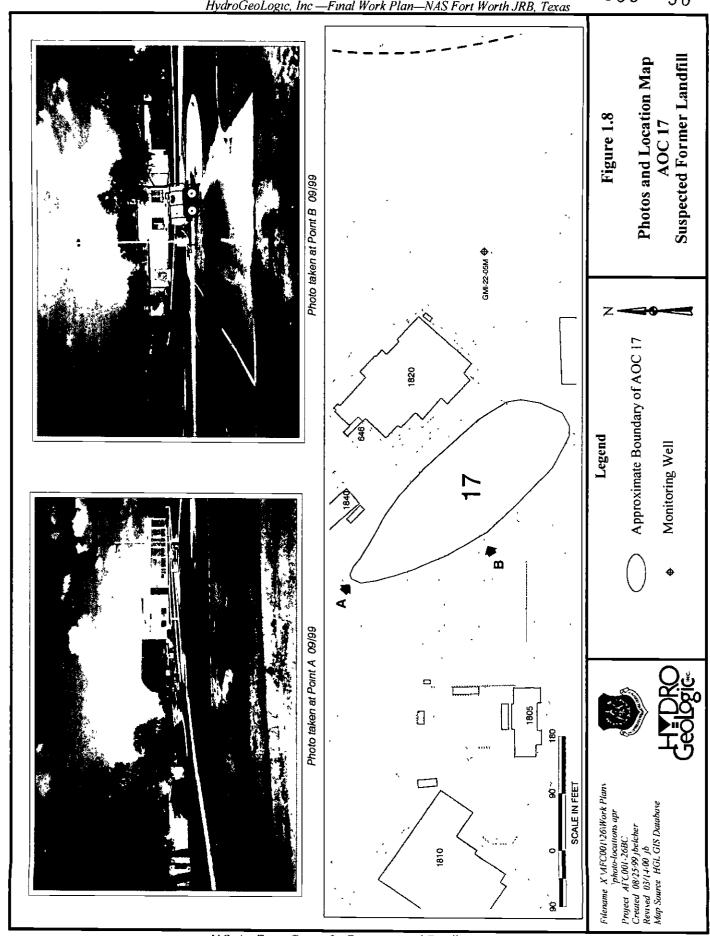
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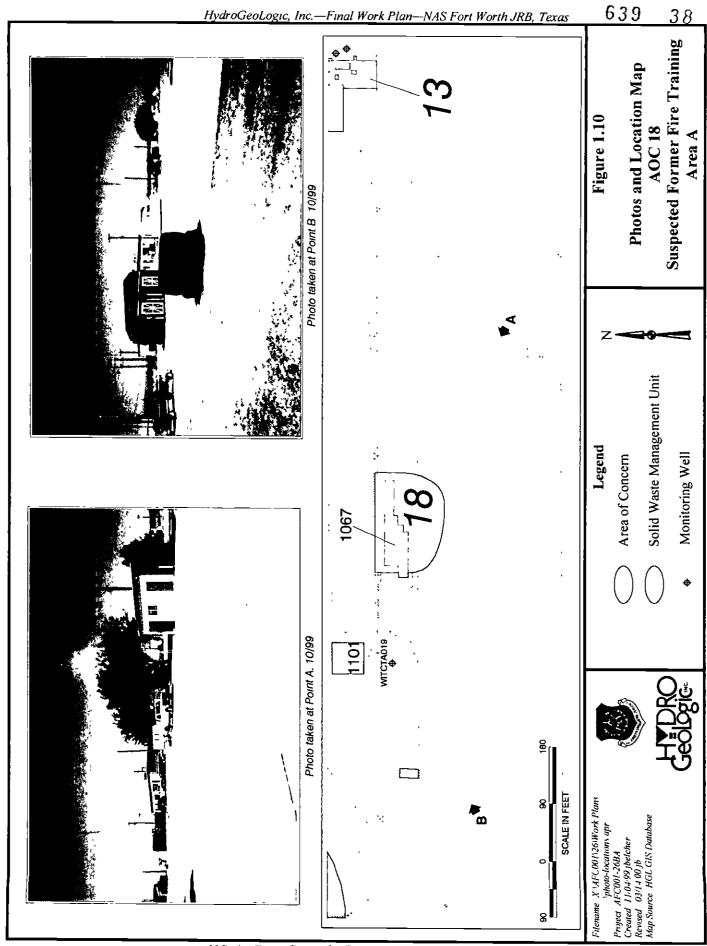
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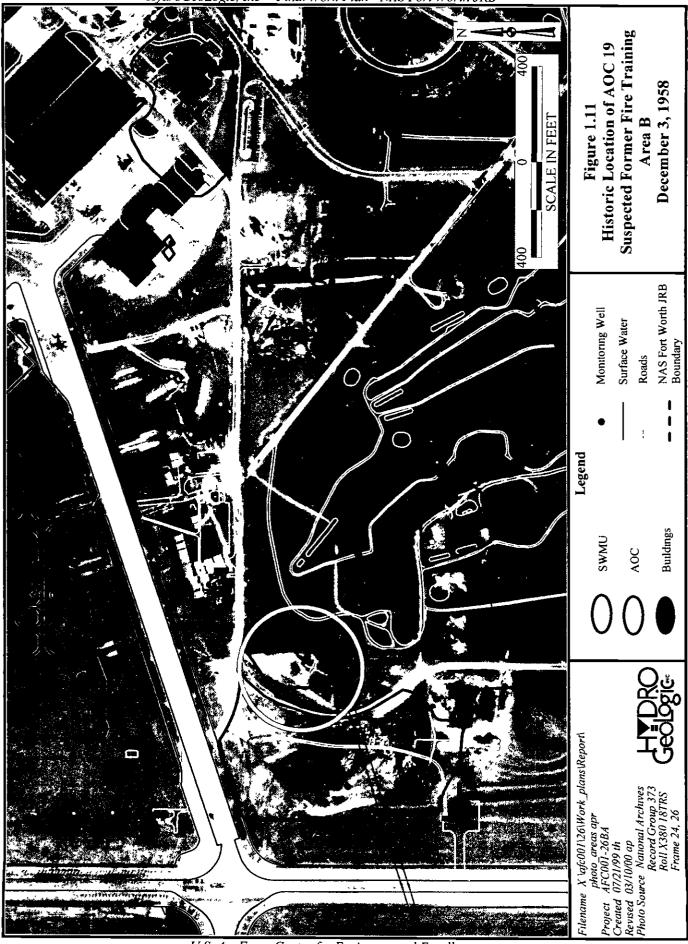
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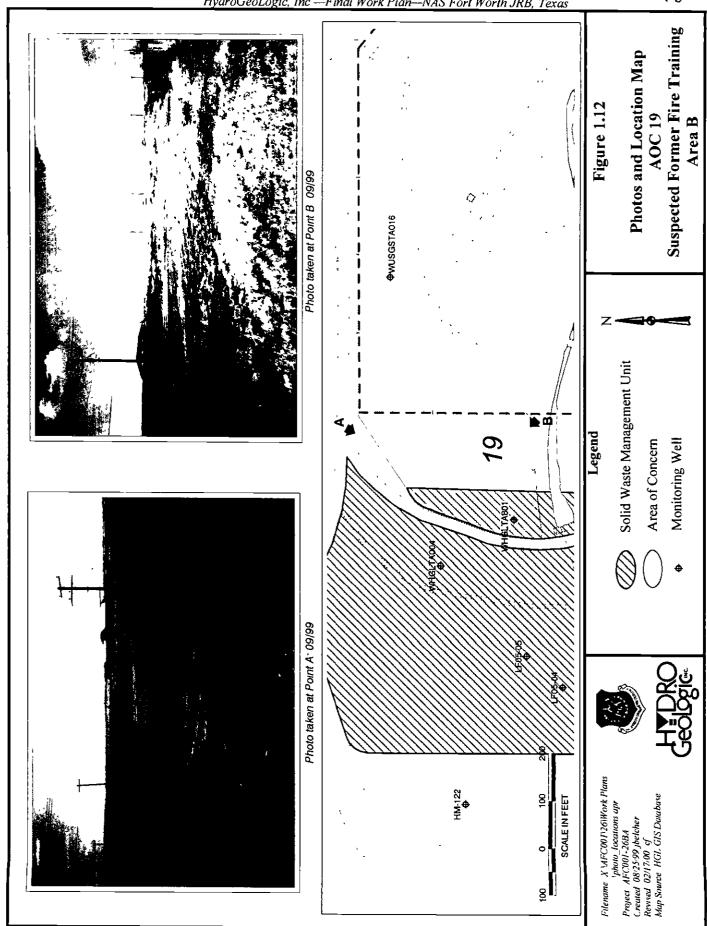
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Section 2

#### 2.0 SUMMARY OF EXISTING INFORMATION

The climate, physiography, geology, hydrology, biology, and demographics of the NAS Fort Worth JRB area are described in the following sections. This data has been primarily derived from the Summary of Remediation Projects at AFP-4 CAFB (Environmental Science and Engineering, Inc. [ESE], 1994) and the Remedial Investigation/Feasibility Study (RI/FS) reports (Radian, 1989a, 1991).

#### 2.1 INSTALLATION ENVIRONMENTAL SETTING

#### 2.1.1 Physiographic Province

NAS Fort Worth JRB is located along the border zone between two physiographic provinces. The southeastern part of the base is situated within the Grand Prairie section of the Central Lowlands Physiographic Province. Most of NAS Fort Worth JRB is located within this province. This region is characterized by broad, eastward-sloping terrace surfaces that are interrupted by westward-facing escarpments. The land surface is typically grass covered and treeless except for isolated stands of upland timber. The northwestern part of the NAS Fort Worth JRB area is situated within the Western Cross Timbers Physiographic Province. This area is characterized by rolling topography and a heavy growth of post and blackjack oaks (Radian, 1989). Surface elevations for this region range from about 850 feet above National Geodetic Vertical Datum (NGVD) west of the base to approximately 550 feet above NGVD along the eastern side of the base. Figure 2.1 is a section of the Lake Worth, Texas, U.S. Geological Survey topographic map showing the relief of the NAS Fort Worth JRB/AFP-4 region.

#### 2.1.2 Regional Geology

The geologic units of interest for the region, from youngest to oldest, are as follows: (1) the Quaternary Alluvium (including fill material and terrace deposits), (2) the Cretaceous Goodland Limestone, (3) the Cretaceous Walnut Formation, (4) the Cretaceous Paluxy Formation, (5) the Cretaceous Glen Rose Formation, and (6) the Cretaceous Twin Mountains Formation. A generalized cross section of the geology beneath NAS Fort Worth JRB is presented in Figure 2.2 (Radian, 1989). The areal limits of surface exposure of these units at NAS Fort Worth JRB are shown in Figure 2.3. Cross section locations and individual cross sections at NAS Fort Worth JRB are presented in Figures 2.4 through 2.7 (CH2M HILL, 1996b). The regional dip of the stratigraphic units beneath NAS Fort Worth JRB is between 35 and 40 feet per mile in an easterly to southeasterly direction. NAS Fort Worth JRB is located on the relatively stable Texas Craton, west of the faults that lie along the Ouachita Structural Belt. No major faults or fracture zones have been mapped near the base.

#### 2.1.3 Groundwater

The water-bearing geologic formations located in the NAS Fort Worth JRB area may be divided into the following five hydrogeologic units, listed from the shallowest to the deepest: (1) an upper perched-water zone occurring in the alluvial terrace deposits associated with the Trinity River, (2) an aquitard of predominantly dry limestone of the Goodland and Walnut Formations, (3) an

aquifer in the Paluxy Sand, (4) an aquitard of relatively impermeable limestone in the Glen Rose Formation, and (5) a major aquifer in the sandstone of the Twin Mountains Formation. Each of these units is examined more explicitly in the following paragraphs. The relationship between these hydrogeologic units and geologic units is illustrated in Figure 2.8 (Radian, 1989a).

#### 2.1.3.1 Alluvial Terrace Deposits

The uppermost groundwater in the area occurs within the pore space of the grains of coarse sand and gravels deposited by the Trinity River. In some parts of Tarrant County, primarily in those areas adjacent to the Trinity River, groundwater from the terrace deposits is used for irrigation and residential use. Groundwater from the terrace deposits is rarely used as a source of potable water due to its limited distribution and susceptibility to surface/storm water pollution (CH2M HILL, 1984).

Recharge to the water-bearing deposits occurs through infiltration from precipitation and from surface water bodies. Extensive on-site pavement and construction restricts this recharge. Additional recharge, however, comes from leakage in water supply lines, sewer systems, storm drains, and cooling water systems. In 1991, this leakage was calculated to be in excess of approximately 115.5 million gallons for NAS Fort Worth JRB and AFP-4 (General Dynamics Facility Management, 1992). This inflow of water to the shallow aquifer effects local groundwater flow patterns and contamination transport, along with increasing hydraulic head, which acts as the force to potentially drive water into lower aquifer systems. The estimated hydraulic conductivity of the alluvial aquifer is 4.57 gallons per day per square foot (gpd/ft²) (Radian, 1989).

This flow between aquifers is restricted by the Goodland/Walnut Formations; therefore, the alluvial terrace groundwater is not hydraulically connected to the underlying aquifers at NAS Fort Worth JRB. The primary water flow in the terrace deposits is generally eastward toward the West Fork of the Trinity River, although localized variations exist across the entire site. The hydraulic gradient across the base is variable, reflecting variations in the flow direction and localized recharge. Discharge from the aquifer occurs into surface water on-site, specifically Farmers Branch Creek.

Potentiometric maps of NAS Fort Worth JRB and AFP-4 alluvial terrace groundwater are presented as Figure 2.9 and Figure 2.10. The data used to create these maps is also presented in Table 2.1. Both the January 1999 and July 1999 groundwater elevation data show an easterly trend in groundwater flow over the area of NAS Fort Worth JRB toward the West Fork of the Trinity River (HydroGeoLogic, Inc. [HydroGeoLogic], 1999a,c).

#### 2.1.3.2 Goodland/Walnut Aquitard

The groundwater within the terrace deposits is isolated from groundwater within the lower aquifers by the low permeability of the Goodland Limestone and Walnut Formations. The primary inhibitors to vertical groundwater movement within these units are the fine-grained clay and shale layers that are interbedded with layers of limestone. Some groundwater movement does occur between the individual bedding planes of both of these units, but the vertical hydraulic conductivity has been calculated to range between 1.2E-09 centimeters per second (cm/sec) to

7.3E-11 cm/sec for the NAS Fort Worth JRB and AFP-4 area. This corresponds to a vertical flow rate that ranges between 1.16E-03 feet per day (ft/d) to 5.22E-03 ft/d (ESE, 1994).

At the AFP-4 "window area," the Goodland/Walnut Aquitard is breached, and the alluvial terrace groundwater is in direct contact with the groundwater in the Paluxy Aquifer. Several wells and borings have been advanced at NAS Fort Worth JRB to the Goodland/Walnut Aquitard. There is no evidence that a similar window exists on the base property. All five monitoring wells that fully penetrate the Paluxy Aquifer on NAS Fort Worth JRB property are represented in cross sections (Figures 2.5 through 2.7). These wells are USGS01P, USGS05P, USGS06P, USGS07P, and Paluxy 1 (P1).

### 2.1.3.3 Paluxy Aquifer

The Paluxy Aquifer is an important source of potable groundwater for the Fort Worth area. Many of the surrounding communities, particularly White Settlement, obtain their municipal water supplies from the Paluxy Aquifer. Groundwater from the Paluxy is also used in some of the surrounding farms and ranches for agricultural purposes. Due to the extensive use of the Paluxy Aquifer, water levels have declined significantly over the years. Water levels in the NAS Fort Worth JRB vicinity have not decreased as much as in the Fort Worth area due to its proximity to the Lake Worth recharge area and the fact that the base does not obtain water from the Paluxy Aquifer. Drinking water at the base is supplied by the city of Fort Worth, which uses Lake Worth as its water source. The groundwater of the Paluxy Aquifer is contained within the openings created by gaps between bedding planes, cracks, and fissures in the sandstones of the Paluxy Formation. Just as the Paluxy Formation is divided into upper and lower sand members, the aquifer is likewise divided into upper and lower aquifers. The upper sand is finer grained and contains a higher percentage of shale than the lower sand. In 1989, Radian estimated the hydraulic conductivity and transmissivity to be 130 to 140 gpd/ft² and 1,263 to 13,808 gpd/ft², respectively.

#### 2.1.3.4 Glen Rose Aquitard

Below the Paluxy Aquifer are the fine-grained limestone, shale, marl, and sandstone beds of the Glen Rose Formation. The thickness of the formation ranges from 250 to 450 feet. Although the sands in the Glen Rose Formation yield small quantities of groundwater in the area, the relatively impermeable limestone acts as an aquitard, restricting water movement between the Paluxy Aquifer above and the Twin Mountains Aquifer below.

### 2.1.3.5 <u>Twin Mountains Aquifer</u>

The Twin Mountains Formation is the oldest and deepest water supply source used in the NAS Fort Worth JRB area. The Twin Mountains Formation occurs approximately 600 feet below NAS Fort Worth JRB, with a thickness of between 250 to 430 feet. Recharge to the Twin Mountains Aquifer occurs west of NAS Fort Worth JRB, where the formation out crops. Groundwater movement is eastward in the downdip direction. The Twin Mountains groundwater occurs under unconfined conditions in the recharge area and becomes confined as it moves downdip. Transmissivities in the Twin Mountains Aquifer range from 1,950 to 29,700 gpd/ft² and average

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8,450 gpd/ft<sup>2</sup> in Tarrant County. Permeabilities range from 8 to 165 gpd/ft<sup>2</sup> and average 68 gpd/ft<sup>2</sup> in Tarrant County (CH2M HILL, 1984).

#### 2.1.3.6 Water Well Survey Results

An inventory of water supply wells within a one-half-mile radius of the NAS Fort Worth JRB boundary was conducted by HydroGeoLogic in 1997. Figure 2.11 illustrates the locations of 59 wells that were identified from Texas Water Commission (TWC) records. All of these wells were installed and completed in the Paluxy Aquifer or the Twin Mountains Aquifer. No active water wells are located on NAS Fort Worth JRB property. Water is supplied to the base by the city of Fort Worth, which obtains water from Lake Worth.

#### 2.1.4 **Surface Water**

The topography of NAS Fort Worth JRB is fairly flat except for the lower lying areas along the tributaries of the Trinity River. The land surface slopes gently northeastward toward Lake Worth and eastward toward the West Fork of the Trinity River. Surface elevations range from about 690 feet above NGVD at the southwest corner of the base to approximately 550 feet above NGVD, along the eastern side of the base. Figure 2.12 is a section of the Lake Worth, Texas, U.S. Geological Survey topographic map showing the relief of the NAS Fort Worth JRB area.

NAS Fort Worth JRB is located within the Trinity River Basin, adjacent to Lake Worth. The lake is a man-made reservoir created by damming the Trinity River at a point just northeast of the base. The surface area of the lake is approximately 2,500 acres. Lake Worth receives a limited amount of storm water runoff from NAS Fort Worth JRB during and immediately after rainfall events. Elevation of the water surface is fairly consistent at approximately 594 feet above NGVD, the fixed elevation of the dam spillway. Part of the eastern boundary of NAS Fort Worth JRB is defined by the West Fork of the Trinity River. River flow is towards the southeast into the Gulf of Mexico. Because the Trinity River has been dammed, the 100- and 500-year flood plains do not extend more than 400 feet from the center of the river or any of its tributaries.

Surface drainage is mainly east towards the West Fork of the Trinity River. The base is partly drained by Farmers Branch Creek, a tributary of the West Fork of the Trinity River. Farmers Branch Creek begins within the community of White Settlement and flows eastward. Just south of AFP-4, Farmers Branch flows under the runway within two large culverts identified as an aqueduct. Most of the base drainage is intercepted by a series of storm drains and culverts, directed to OWSs, and discharged to the West Fork of the Trinity River downstream of Lake Worth. A small portion of the north end of the base drains directly into Lake Worth.

NAS Fort Worth JRB currently has three storm water discharge points that are subject to National Each discharge point is Pollution Discharge Elimination System (NPDES) requirements. monitored weekly for chemical oxygen demand, oil and grease, and pH. The permit has been violated on numerous occasions. In 1979, these violations prompted the EPA to formally demand a corrective action (CH2M HILL, 1984). Several additional sampling points were established to determine the flow of pollutants onto and off of the base. Samples were collected for a variety of parameters (spills, fish kills, odors, and oil sheen) as circumstances dictated (Radian, 1989a,b).

#### 2.1.5 Air

The climate in the Fort Worth area is classified as humid subtropical with hot summers and dry winters. Tropical maritime air masses control the weather during much of the year, but the passage of polar cold fronts and continental air masses can create large variations in winter temperatures. The average annual temperature in the area is 66 degrees Fahrenheit (°F), and monthly mean temperatures vary from 45°F in January to 86°F in July. The average daily minimum temperature in January is 35°F, and the lowest recorded temperature is 2°F. The average daily maximum temperature in July and August is 95°F, and the highest temperature ever recorded at the base was 111°F. Freezing temperatures occur at NAS Fort Worth JRB an average of 33 days per year (TNRCC, 1996d).

Mean annual precipitation recorded at the base is approximately 32 inches. The wettest months are April and May, with a secondary maximum in September. The period from November to March is generally dry, with a secondary minimum in August. Snowfall accounts for a small percentage of the total precipitation between November and March. Thunderstorm activity occurs at the base an average of 45 days per year, with the majority of the activity between April and June. Hail may fall 2 to 3 days per year. The maximum precipitation ever recorded in a 24-hour period is 5.9 inches. On the average, measurable snowfall occurs 2 days per year (TNRCC, 1996d).

Lake evaporation near NAS Fort Worth JRB is estimated to be approximately 57 inches per year. Evapotranspiration over land areas may be greater or less than lake evaporation depending on vegetative cover type and moisture availability. Average net precipitation is expected to be equal to the difference between average total precipitation and average lake evaporation, or approximately minus 25 inches per year. Mean cloud cover averages 50 percent at NAS Fort Worth JRB, with clear weather occurring frequently during the year. Some fog is present an average of 83 days per year. Wind speed averages 7 knots; however, a maximum of 80 knots has been recorded. Predominant wind direction is from the south-southwest throughout the year (TNRCC, 1996d).

Air quality in the Dallas-Fort Worth area meets EPA National Ambient Air Quality Standards for carbon monoxide, nitrogen dioxide, sulfur dioxide, and respirable particulate matter. However, ozone levels exceed national standards, and the ozone pollution level in the area has a Federal classification of moderate. During 1996, ozone measurements showed an arithmetic mean concentration of 0.033 parts per million in North Tarrant County. Actual exceedances of the national standards for ozone concentrations was calculated to be 2 days for the measurement station in North Tarrant County. Additional control measures are being implemented as a result of 1990 Federal Clean Air Act mandates to bring the area into compliance with the national standard (TNRCC, 1996d).

#### 2.1.6 Biology

Approximately 374 acres, or 14 percent, of NAS Fort Worth JRB is considered unimproved, indicating the presence of seminatural to natural biological/ecological conditions. The base lies in the Cross Timbers and Prairies Regions of Texas, where native vegetation is characterized by

alternating bands of prairies and woodlands. The higher elevations on the base are covered by native and cultivated grasses such as little bluestem, Indian grass, big bluestem, side oats, grama, and buffalo grass. Forested areas occur primarily on the lower land and along the banks of streams. Common wood species include oak, elm, pecan, hackberry, and sumac. Several non-native species such as catalpa and chinaberry are common (Radian, 1989).

Typical wildlife on the base includes black-tailed jackrabbits in grassy areas along the runway. In addition, there are cotton-tail rabbits, gray squirrels, and opossums in the wooded areas. Common birds include morning doves, meadowlarks, grackles, and starlings. Hunting and trapping are not allowed on the base, but in the nearby rural areas they are a very popular form of recreation (Radian, 1989).

Reported game fish include black bass, sunfish, and catfish, all of which can be found in Lake Worth, Farmers Branch Creek, and one small pond located on base near the golf course equipment shed. According to the Texas Department of Parks and Wildlife and the U.S. Fish and Wildlife Service, there are no threatened or endangered species known to occur on NAS Fort Worth JRB. None of the federally listed endangered plant species for Texas are known to occur within 100 miles of Tarrant County. Of the federally listed endangered animals species, only the peregrine falcon and the whooping crane are known to occasionally inhabit the area; however, none of these is suspected to reside in the vicinity of NAS Fort Worth JRB (Radian, 1989).

#### 2.1.7 Demographics

The following sections describe the regional and site-specific demographics as they relate to the Fort Worth, Texas, area and NAS Fort Worth JRB.

#### 2.1.7.1 Regional Demographics

Approximately 1,278,606 people reside within Tarrant County, Texas (U.S. Department of Commerce, 1996). Of this population, 485,650 reside within the city limits of Fort Worth. Several smaller cities and villages make up the remainder of the population. The communities of White Settlement, Lake Worth, Westworth Village, River Oaks, and Sansom Park lie within a 3-mile radius of NAS Fort Worth JRB. The following populations that reside in the cities and villages are based on 1994 census data: White Settlement (city) - 16,502, Lake Worth (city) - 4,694, Westworth Village (town) - 2,502, River Oaks (city) - 6,747, and Sansom Park (city) - 4,136 (U.S. Department of Commerce, 1994). Six schools are within a 2-mile radius of NAS Fort Worth JRB; the closest is 0.5 miles south (RUST, 1995).

The area surrounding NAS Fort Worth JRB is highly urbanized due to its proximity to the city of Fort Worth. The area is comprised of a combination of residential, commercial, and light industrial properties that employ the majority of local residents (RUST, 1995).

#### 2.1.7.2 <u>Site-Specific Demographics</u>

The current full-time population at NAS Fort Worth JRB is approximately 3,600 people, comprising 400 officers, 1,400 civilians, and 1,800 active reservists. Part-time military reservists will increase this population to over 6,000 military personnel (CH2M HILL, 1997).

Approximately 86 percent of NAS Fort Worth JRB has been developed by way of buildings, roads, parking lots, runways, and housing and recreational areas. On-site activities include various maintenance, inspection, and support activities for fuel systems, weapons, jet engines, AGE, and specialized ground equipment (HydroGeoLogic, 1997).

#### 2.2 SITE-SPECIFIC ENVIRONMENTAL SETTING

The following sections describe the site-specific environmental setting of NAS Fort Worth JRB. Site-specific information at the SWMUs and AOCs is very limited because no previous investigations have been performed.

#### 2.2.1 Site-Specific Soils

The U.S. Soil Conservation Service has identified four major soil associations in the area of NAS Fort Worth JRB. The first association is the surficial soils of the nearly level to gently sloping clayey soils of the Sanger-Purves-Slidell Association. Second is the Aledo-Bolar-Sanger Association, which is located within the southwestern portion of the Sanger-Purves-Slidell Association and is characterized as an increasingly loamy clayey soil of gentle to moderate slope. The third association, the Bastsil-Silawa Association separates the Sanger-Purves-Slidell Association from the Frio-Trinity Association. The Bastsil-Silawa Association is characterized as a sandy clay loam of nearly level slope (ESE, 1994). The clayey soils of the Frio-Trinity Association make up the fourth soil association and are located along the flood plain of the West Fork of the Trinity River. The areal limits of each of these soil associations and their occurrence on-site are shown in Figure 2.13.

#### 2.2.2 Site-Specific Geology

The majority of NAS Fort Worth JRB is covered by alluvium deposited by the Trinity River during flood stages. The Quaternary Period alluvium (Holocene Epoch) occurs downstream from the Lake Worth Dam in the current flood plain of the West Fork of the Trinity River, on the east side of the facility. Older alluvial deposits and terrace deposits (Pleistocene Epoch) also occur onsite. The alluvium is composed of gravel, sand, silt, and clay of varying thicknesses and lateral extent. The thickness of these materials ranges from 0 to 60 feet. Fill material is also included within these deposits where landfills, waste pits, excavation sites, and other construction activities have altered the original land surface. This fill material is made up of clay, silt, sand, and gravel mixtures, but may also contain debris and other waste (Radian, 1989).

Below the alluvial terrace deposits are the Cretaceous-age Goodland and Walnut Formations, which form the bedrock surface beneath NAS Fort Worth JRB. Both formations consist of interbedded, fossiliferous, hard limestone and calcareous shale. The upper formation, the

Goodland Limestone, is exposed on the southern portion of the base, south of White Settlement Road. The Goodland is a chalky-white, fossiliferous limestone and marl. The thickness of the Goodland Limestone ranges from 20 to 25 feet. Below the Goodland Formation is the Walnut Formation (or Walnut Clay). The Walnut Formation is exposed in a small area along the shores of Lake Worth and Meandering Road Creek. This formation is a shell agglomerate limestone with varying amounts of clay and shale. It ranges in thickness from 25 to 35 feet throughout the site except where erosion has produced a few thinner areas. Subsurface investigations have located troughs and paleochannels that are eroded into the top of the bedrock at NAS Fort Worth JRB. These paleochannels are typical of an erosional surface modified by fluvial processes and are filled with sand and gravel deposits ranging in thickness from 15 to 35 feet (CH2M HILL, 1996b).

Below the Walnut Formation is the Paluxy Formation (or Paluxy Sand). The Paluxy Formation underlies all of NAS Fort Worth JRB. The formation consists of several thick sandstone layers that are separated by thin, discontinuous shale and claystone layers. Sandstones in the formation are primarily a fine-to coarse-grained sand with minor amounts of clay, sandy clay, pyrite, lignite, and shale. The lower section of the Paluxy is generally coarser-grained than the upper section (CH2M HILL, 1996b). Total formation thickness ranges from 130 to 175 feet, with variable thickness and occurrence of individual layers across the site. Only one unit in this formation, a shale/silty shale, can be extensively mapped across the base.

The older Glen Rose and Twin Mountains Formations are not exposed at NAS Fort Worth JRB. The Glen Rose Formation consists primarily of calcareous sedimentary rock and some sands, clays, and anhydrite. The Glen Rose caps the Twin Mountain Formation, which is the oldest Cretaceous Formation in the NAS Fort Worth JRB area. The Twin Mountain Formation consists of a basal conglomerate of chert and quartz, grading upward into coarse- to fine-grained sand interspersed with varicolored shale.

## TAB

Tables

Table 2.1
Groundwater Elevations Measured January 1999 and July 1999
NAS Fort Worth JRB, Texas

Monitoring well	Coordinates		Top of Casing	Groundwater Elevation	
	Easting	Northing	Elevation (ft above msl)	January 1999 (ft above msl)	July 1999 (ft above msl)
15B	2301032.08	6963338.735	567.59	559.26	558.58
17 <b>l</b>	2299626.674	6963642.662	578 13	566.08	564.68
17J	2299584.431	6963780.053	579 94	567.15	565.96
17K	2299799.209	6963578.343	575.47	564.81	563.72
17L	2299741.167	6963812.735	577.32	565.58	564.24
17M	2300037.62	6963761 95	574.28	564.23	563.06
BGSMW01	2299511	6964916 44	578.64	570.66	569.63
BGSMW02	2299618.19	6965006.79	577 57	566.03	564.69
BGSMW03	2299690.06	6965067 5	576.72	565 97	564.68
BGSMW04	2299589.5	6965084.53	578.49	566.31	564.96
BGSMW05	2299961.23	6965150.67	571.66	565.58	564.41
BGSMW06	2299910.09	6964981.31	576.51	565.92	564 62
BGSMW07	2299737.83	6964990.68	574.88	566.40	565.06
BSS-A	2300115.431	6965491.098	566.49	561.63	560.89
BSS-B	2300091.9	6965797.6	569.40	559.99	559.14
FT08-11A	2295876.4	6962318.1	608.15	595.64	595.39
FT08-11B	2295928.5	6962030.9	608.05	597.93	597.12
FT09-12A	2295439.2	6960549.8	635.38	618.59	616.88
FT09-12B	2295697.4	6960709.3	627.36	595.78	595.99
FT09-12C	2295771.5	6960590.3	627.86	595.69	1
FT09-12D	2295743.4	6960887.6	627.26	596.18	596 26
FT09-12E	2295821.2	6960701.1	627 34	595.66	595.68
GMI-04-01M	2296724.6	6960930.7	613.79	593.86	594.11
GMI-22-02M	2296187.4	6966632 9	619 13	610.48	609.11
GMI-22-03M	2298539,4	6966219.9	608.03	587.19	587.02
GMI-22-04M	2297340.5	6967250.5	610.70	590 60	1
GMI-22-05M	2299432.1	6966940.3	584.28	572.74	571.91
GMI-22-06M	2298186.6	6967004.5	606.84	588.11	587.86
GMI-22-07M	2298322 5	6969018.7	605,66	588 66	_1
GMI-22-08M	2298971,5	6970323.6	606.94	589.22	589.26
HM-110	2293163,2	6963667.5	637.33	609.12	608.93
HM-111	2293265.658	6963623.549	636.49	608.99	608 72
HM-112	2293141.648	6964217,563	638,06	608.49	608.14
HM-114	2294352	6963912.1	627 77	609.18	608,59
HM-116	2294283.7	6966411 4	634.06	610.98	610.47
HM-117	2294274.3	6967355.4	633.32	611.47	610.93
HM-118	2294780.5	6968035.2	626.23	610 79	610.28
HM-119	2294271.8	6968726	625.04	611.28	611.04
HM-120	2295343.2	6969489	616.84	612 15	610.66
HM-121	2295279,2	6967390.2	627.66	609.77	609.48

## Table 2.1 (continued) Groundwater Elevations for January 1999 and July 1999 NAS Fort Worth JRB

	Coordinates		Top of Casing	Groundwater Elevation	
Monitoring well	Easting	Northing	Elevation (ft above msl)	January 1999 (ft above msl)	July 1999 (ft above msl)
HM-122	2295260.535	6962891.108	619.44	600.37	600.04
HM-123	2295272.6	6961638 5	624.85	597.97	597 94
HM-124	2295223.3	6963957.8	623.26	608 06	607.34
HM-125	2295220.29	6965893.458	629 37	605.17	610.45
HM-126	2294300.2	6963121	622.99	607.14	606.67
HM-127	2294853.3	6961588.5	624.04	598 64	598.52
ITMW-01T	2298967.14	6961062.05	602.77	590.35	589.55
LF01-1A	2301249.8	6964466.4	570.27	2	2
LF01-1B	2301057.006	6964700.806	560.18	546.26	544.28
LF01-1C	2301376.05	6964438 037	562.15	544.07	542.64
LF01-1D	2301376.03	6964288.176	563.91	544.61	543.29
LF01-1 <u>D</u> LF01-1E	2301174.3	6964606 025	562.11	544.57	543.25
LF03-3D	2293269.12	6962056.65	625.25	612.52	1
LF04-01	2295382.891	6961027.715	629.16	597.30	597.33
LF04-01 LF04-02	2296309.1	6961113.1	623.44	594.49	594.42
LF04-02 LF04-04	2297165.6	6960941.6	611.95	592 86	592.72
LF04-10	2297078.9	6960411.8	626.47	593.28	593.21
LF04-10 LF04-4A	2295852.984	6960300 484	625.84	612.03	610.96
LF04-4B	2296274 338	6960323.911	619.95	600.89	598.49
LF04-4B LF04-4C	2296593.501	6960604 002	612.96	593.84	593.67
LF04-4D	2296416 385	6960831.587	615.13	594.30	594.17
LF04-4E	2296410.998	6961036.036	618.49	594.35	594 25
LF04-4E	2296058.767	6961061.85	625.28	596.31	595.35
LF04-4G	2296658.929	6961224.127	619.75	593.53	593.37
LF04-4H	2296721.26	6960928.75	613.43	594.68	595.28
LF05-01	2294577.8	6962728 3	621.88	,602.08	1
LF05-02	2295278.9	6962653.1	622.61	597.59	598.63
LF05-02 LF05-18	2297075.4	6961555.6	611.71	592.27	591.99
LF05-19	2297461.4	6961239.9	606.05	591.66	1
LF05-19 LF05-5A	2295580.898	6961438.557	623 00	597.33	598.30
LF05-5A LF05-5B	2296078.248	6961901.555	597 17	592.54	588.59
LF05-5B LF05-5C	2295993.73	6961720.051	608.56	596.65	596.36
LF05-5C	2295757.035	6961740.466	611.40	597.78	597.68
LF05-5E	2295550.36	6961177.867	626.70	597.26	597.27
LF05-5E	2296336.36	6961288.64	618.95	6	594.11
LF05-5G	2296536.324	6961581.317	615.28	593.85	1
LF05-5H	2296343.797	6961735.963	610.61	594.53	594.07
LSA1628-1	2297802.1	6967936.2	601.67	591.32	590 97
LSA1628-2	2297846 5	6967943.3	601.93	591.10	590.93
LSA1628-2 LSA1628-3	2297791 257	6967993.079	601.73	591.28	591.0 <u>6</u>

Table 2.1 (continued)
Groundwater Elevations for January 1999 and July 1999
NAS Fort Worth JRB

	Coordinates		Top of Casing	Groundwater Elevation	
Monitoring well	Easting	Northing	Elevation (ft above msl)	January 1999 (ft above msl)	July 1999 (ft above msl)
LSA1628-14	2297896.92	6967908.30	601.60	590.73	590.39
LSA1628-15	2297860.79	6967862.87	601.35	590.75	590.35
MW-10	2300541.575	6965836 203	558.85	544 73	544.14
MW-11	2300791.955	6965706.661	558.17	531.90	531.15
MW-11A	2297057.278	6965810.342	612.17	589.32	589.36
MW-12	2300142.021	6966149.318	559.62	549 57	549.18
MW-12A	2295756.2	6961041.92	625.03	3	3
MW-13	2295736.39	6961035.09	620.83	3	3
MW-18	2295389.85	6963519.14	621.19	603.29	602.91
MW-19	2295368.85	6963512.61	611.28	593.67	593.36
MW-2	2300555.919	6965704.96	557.55	546.30	545.43
MW-20	2296878.439	6963365 698	611 38	3	3
MW-21	2296841.863	6963382.211	589.89	570.61	570.60
MW-3	2299750.342	6965242.674	576.48	565.21	563.91
MW-36	2299356.658	6965034.802	604.11	599.52	599.01
MW-37	2299384.988	6965061.349	590.53	581.42	581.63
MW-38	2298153.077	6965981.092	604.11	587.84	587.71
MW-39	2298171.115	6965999.012	604.12	587.88	587.69
MW-4	2300090.055	6965802.687	566.67	560.47	559 66
MW-40	2298224.978	6966053.097	604.16	590.16	587.52
MW-41	2298204.568	6966088.853	604.66	587.68	587.70
MW-42	2298144.896	6966031.035	604.60	587.85	587.69
MW-48	2295643.543	6968478.952	619.33	609.33	609.01
MW-49	2295623.167	6968470.498	619.48	609.27	608.90
MW-5	2300138 608	6965803.452	563.69	560.45	558.59
MW-50	2295621.7	6968528.648	619 27	609.23	609.27
MW-51	2295639 958	6968536.471	619.36	609.26	609.05
MW-52	2296182 561	6964355.172	616.29	602.15	600.00
MW-53	2296200.241	6964378.184	616.75	601.90	599.83
MW-56	2296055 932	6968789.529	614.32	606.63	606.47
MW-57	2297112.98	6967217.16	613.37	600.06	601.56
MW-57B	2296034.177	6968836.004	613.78	606.41	606.36
MW-58	2297175 216	6966950.884	612.94	593.64	593.65
MW-59	2297160.82	6966970.471	613.37	594.84	594.63
MW-6	2300173.696	6965734.917	562 87	560.83	560.25
MW-7	2300055 237	6965967.108	567.37	559.01	558.62
MW-8	2300491.789	6965584.178	557.04	549.19	548.87
MW-9	2300329.174	6966001.958	559.54	548.92	548.44
MW-IT-02T	2292594	6965339	647.09	612.19	611.77
MW1-16	2300066.63	6963755.16	559.62	549 80	549.56

Table 2.1 (continued)
Groundwater Elevations for January 1999 and July 1999
NAS Fort Worth JRB

	Coordinates		Top of Casing	Groundwater Elevation	
Monitoring well	Easting	Northing	Elevation (ft above msl)	January 1999 (ft above msl)	July 1999 (ft above msl)
MWMTAC-001	2296520.35	6959115.8	645.04	610.35	610.53
OT-15C	2300947.512	6963316.339	564.25	555.93	555.36
SAV-1	2300298.887	6965776.357	560.15	547.95	547.51
SAV-2	2300280.415	6965807 583	560.07	548.19	547.73
SD13-01	2300621.423	6963391.743	573.09	561.01	1
SD13-01 SD13-02	2300753.03	6963487.702	573.28	560.24	1
SD13-02 SD13-03	2300699.63	6963362.921	571.41	560.36	559.87
SD13-03	2300770.955	6963361.521	569.08	559.65	1
SD13-05	2300775.292	6963904.275	571 54	562 24	561 77
SD13-06	2300907.827	6963164.35	557.68	548.96	545 71
SD13-07	2301009.342	6963167.041	560.44	543.53	541.55
SPOT35-1	2296878.532	6966202.395	613.59	590.84	590.68
SPOT35-2	2296854.203	6966175.289	613.64	591.09	594.06
SPOT35-3	2296850.617	6966108.748		4	_4
SPOT35-4	2296777.882	6966174 924	612.74	591.95	591 76
SPOT35-5	2296846 726	6966020.036	614.09	592.13	592 60
SPOT35-6	2296634.627	6966234.614	615.68	592.57	592.18
SPOT35-7	2296508.592	6966534.791	616.41	609.32	608.97
ST14-01	2300090.8	6963295.3	575 95	562 05	561.29
ST14-02	2300091.7	6963511.6	575.51	563.17	1
ST14-03	2299891.6	6964080	576.68	566.46	564.84
ST14-04	2300345.3	6963642.7	575.61	563.12	1
ST14-14	2299735.22	6964309.76	575.50	567.84	566.10
ST14-24	2299084.2	6964017.889	594.14	582.76	1
ST14-25	2299065.36	6964563.76	592.94	586.83	586.48
ST14-26	2299557.04	6964593.25	581.09	568.99	1
ST14-27	2300212.35	6964257.94	573.85	564.98	563.74
ST14-28	2300495.99	6963728.32	574.45	562.66	1
ST14-29	2300512.775	6963527.787	571.45	562.02	1
ST14-30	2300466.182	6963211.534	566.87	561.33	560.26
ST14-W05	2299093.85	6963726.062	593.63	584 88	584.61
ST14-W06	2299330.792	6963806.563	581.42	569.63	568.07
ST14-W07	2299393.809	6963614.609	579.96	566.67	565.24
ST14-W08	2299479.591	6964323.981	580.54	569.21	567.92
ST14-W09	2299550.097	6963471.685	575.54	566.09	565.08
ST14-W10	2299730.125	6963949.34	573.99	566.31	565.39
ST14-W11	2299657.972	6964128.603	576.31	568.01	566.34
ST14-W12	2299581.062	6963953.266	575.52	568.57	569.41
ST14-W13	2299776.442	6963695.163	574.49	564.59	563.58
ST14-W15	2299923.113	6963315.787	573.47	562.84	562.04

Table 2.1 (continued)
Groundwater Elevations for January 1999 and July 1999
NAS Fort Worth JRB

	Coordinates		Top of Casing	Groundwater Elevation	
Monitoring well	Easting	Northing	Elevation (ft above msl)	January 1999 (ft above msl)	July 1999 (ft above msl)
ST14-W16	2300128.304	6964064.608	573.62	565.27	564.00
ST14-W18	2300162.474	6963906.725	573. <b>7</b> 9	565.04	1
ST14-W19	2300203.607	6963699.799	573.31	563.63	562,59
ST14-W20	2300275.355	6964009.08	573.48	564.25	563.17
ST14-W21	2300242.02	6963417.822	572 88	565.62	1
ST14-W22	2301016.385	6963649.635	571.30	561.18	560.63
ST14-W23	2300410.368	6962949 056	565.60	559.97	557.65
ST14-W31	2300830 861	6963549.672	571.23	560.74	1
ST14-W32	2300815.069	6963239.017	564.15	559.80	558.98
USGS01T	2297661.3	6970397.8	604.78	591.98	
USGS03T	2300610	6968704.7	575.02	571.63	570.13
USGS04T	2299178 7	6968773	604.92	586 02	585.81
USGS06T	2297542.1	6963777.9	606.67	588.08	587.91
USGS07T	2295246.5	6960182.5	632.43	621.12	1
W-153	2294096.2	6965106.3	631.57	610.76	610.11
WCHMHTA001	2293702.384	6966632.501	639.08	610.85	610.14
WCHMHTA002	2294818.468	6967545.100	631.32	610.42	610.02
WCHMHTA003	2295039.039	6967958.333	631 00	610.21	609.70
WCHMHTA004	2295041.059	6967949.303	631.25	610.24	609.79
WCHMHTA005	2295662.842	6967495.679	626.95	609.59	609 14
WCHMHTA006	2295671.903	6967494.615	626 73	609.54	609.18
WCHMHTA007	2295910.42	6967910.326	623.93	609.21	608.91
WCHMHTA008	2295862.693	6968694.421	622.85	609.20	608 87
WCHMHTA009	2296663.993	6968444.685	615.55	608.96	608.52
WCHMHTA010	2296660.061	6968440.059	615.35	608 55	608.44
WCHMHTA011	2297328.375	6969295.196	605.80	592.84	592.76
WCHMHTA012	2297691.142	6968645.437	605.85	591.52	591.42
WCHMHTA013	2300051.586	6967055.521	578.26	561.26	1
WCHMHTA014	2294337.637	6971208.882	619.11	609.51	609.52
WHGLTA002	2296111.39	6962377.91	608.52	594.54	593.96
WHGLTA003	2298029.84	6961043.88	614.22	591.98	591.81
WHGLTA004	2295760,62	6962943 38	614.35	596.03	1
WHGLTA005	2301043.78	6963469.85	570.56	557.36	1
WHGLTA007	2301093.17	6963162.46	552.88	539.01	537.36
WHGLTA008	2300016.84	6963955.17	572 37	565.58	564.19
WHGLTA009	2297528.7	6965211.65	612.09	588.42	688 36
WHGLTA010	2296770.93	6965580.03	618 13	592.28	592.09
WHGLTA011	2295873.87	6968356 67	619.71	608.62	608.45
WHGLTA012	2297740	6965920.84	606.64	588.15	587.97
WHGLTA013	2297177,07	6965957.77	611 13	589.20	588 98

Table 2.1 (continued)
Groundwater Elevations for January 1999 and July 1999
NAS Fort Worth JRB

	Coordinates		Top of Casing	Groundwater Elevation	
Monitoring well	Easting	Northing	Elevation (ft above msl)	January 1999 (ft ábove msl)	July 1999 (ft above msl)
WHGLTA014	2297373.92	6966295.34	610.26	589.32	589.15
WHGLTA201	2298660.88	6963198.14	603.21	584.74	584.35
WHGLTA202	2298832.59	6963326.21	603.45	584.74	584.37
WHGLTA203	2298400.38	6963058.53	600.98	585.08	3
WHGLTA204	2298104.66	6963625.62	605 57	587.60	587.45
WHGLTA302	2294422.27	6962602.64	621.70	602.76	602.19
WHGLTA303	2294400.77	6962351.21	622.77	600.62	600.86
WHGLTA601	2297473.69	6962752.66	600.00	585.81	585.20
WHGLTA602	2297625.01	6965211.65	612.09	·597.14	597.04
WHGLTA603	2297727.19	6962713.38	600.92	584.77	584.13
WHGLTA604	2297530.02	6963195 39	607.43	587.97	587 <u>.</u> 66
WHGLTA701	2295332.86	6961835.73	623.08	589.20	598.22
WHGLTA702	2295882.07	6961920.16	609.41	597.62	597 46
WHGLTA703	2295741.23	6961680.7	615.07	597.83	597.77
WHGLTA704	2295831.51	6962141.07	608.84	598.25	597.90
WITCTA001	2296446.73	6969591.007	610.85	1	1
WITCTA002	2296135.475	6969258.49	613.36	609.54	608.63
WITCTA003	2297405.052	6969111.3	607.58	593.15	593.08
WITCTA004	2297490.47	6968938.831	606.62	592.96	592.94
WITCTA005	2298166.787	6968458.461	602.81	590.04	589.99
WITCTA006	2298261.857	6968425.939	602_76	589 85	589.78
WITCTA007	2298432.068	6968309.561	603.03	588.33	588 22
WITCTA008	2298030.119	6967939.663	600.62	591.85	591.58
WITCTA009	2298232 895	6967860 597	597.15	590.64	590.25
WITCTA010	2298752.182	6967693.534	600.31	585.67	1
WITCTA011	2297357.309	6967455,258	610.27	593.23	592.97
WITCTA012	2298224.392	6967348.773	599.93	589.38	589 05
WITCTA013	2297750.979	6967015.62	605.39	589.98	1
WITCTA014	2297417.505	6966903.565	611.74	590.79	590.62
WITCTA015	2298395.024	6966332.667	606.84	588.60	588.46
WITCTA016	2298061.326	6966238.285	607.85	588 91	588.76
WITCTA017	2299305.778	6967298.148	592.94	584.22	<u>1</u>
WITCTA019	2298838.013	6963107 247	600.82	585.78	585.41
WITCTA020	2296316.788	6963895.317	616.78	594.88	593.98
WITCTA021	2298718.156	6963794.398	604.19	588.36	588.23
WITCTA022	2298742.854	6963649.916	604.17	586.71	586.37
WITCTA024	2298956.02	6965971.777	604.86	587.76	1
WITCTA025	2299534,282	6966004.916	595.20	584.76	584.44
WITCTA026	2299480.089	6965456.85	584.37	578.74	575.41
WITCTA027	2299510.856	6965193 741	581.44	570,25	568.64

### Table 2.1 (continued) Groundwater Elevations for January 1999 and July 1999 NAS Fort Worth JRB

	Coordinates		Top of Casing	Groundwater Elevation	
Monitoring well	Easting	Northing	Elevation (ft above msl)	January 1999 (ft above msl)	July 1999 (ft above msl)
WITCTA028	2300621.253	6965160.619	558.11	550.41	546.88
WITCTA031	2299152 204	6964689.931	592.10	587.82	587.60
WITCTA032	2299195.636	6964500.665	587 37	580 92	580.00
WITCTA033	2300475.241	6964323.666	574.06	565.02	
WITCTA034	2300951.486	6963956.683	571 95	563.18	565.70
WITCTA035	2299093.681	6963387.121	599.37	585.72	585.33
WITCTA036	6963181.649	2299629.281	578.57	5	5
WITCTA037	2297784.441	6963424.036	604.19	588.84	588 59
WITCTA039	2295415.407	6962339.771	619.47	599.67	600.65
WITCTA041	2299642.10	6963168.75	577.97	563.86	562.69
WITCTA042	2299653.16	6963108.38	576.76	563.67	562.59
WITCTA043	2299724 86	6963110.05	576 72	563.53	562.55
WITCTA044	2299836	6963055.72	575.76	562.69	561.87
WJETA530	2296533.87	6959546.93	639.39	604.68	605.29
WJETA531	2295893.78	6958908.59	644.17	619 98	619.32
WJETA534	2296341.54	6958941.15	647.38	614.42	614.03
WJETA535	2296794.44	6959722.27	634.61	601.71	602.27
WP07-10A	2295807.3	6961290	626.50	596.87	597.00
WP07-10B	2296040.4	6961277.5	624.22	595.87	_1
WP07-10C	2296062.4	6961575 6	617.18	595 93	595 64

#### Notes:

Elevations are reported in feet above mean sea level (MSL).

- Groundwater elevation could not be determined.

<sup>&</sup>lt;sup>1</sup> Groundwater is below the top of the dedicated pump, will be measured annually (January 2000).

<sup>&</sup>lt;sup>2</sup> Monitoring well was not found.

<sup>&</sup>lt;sup>3</sup> Monitoring well is dry.

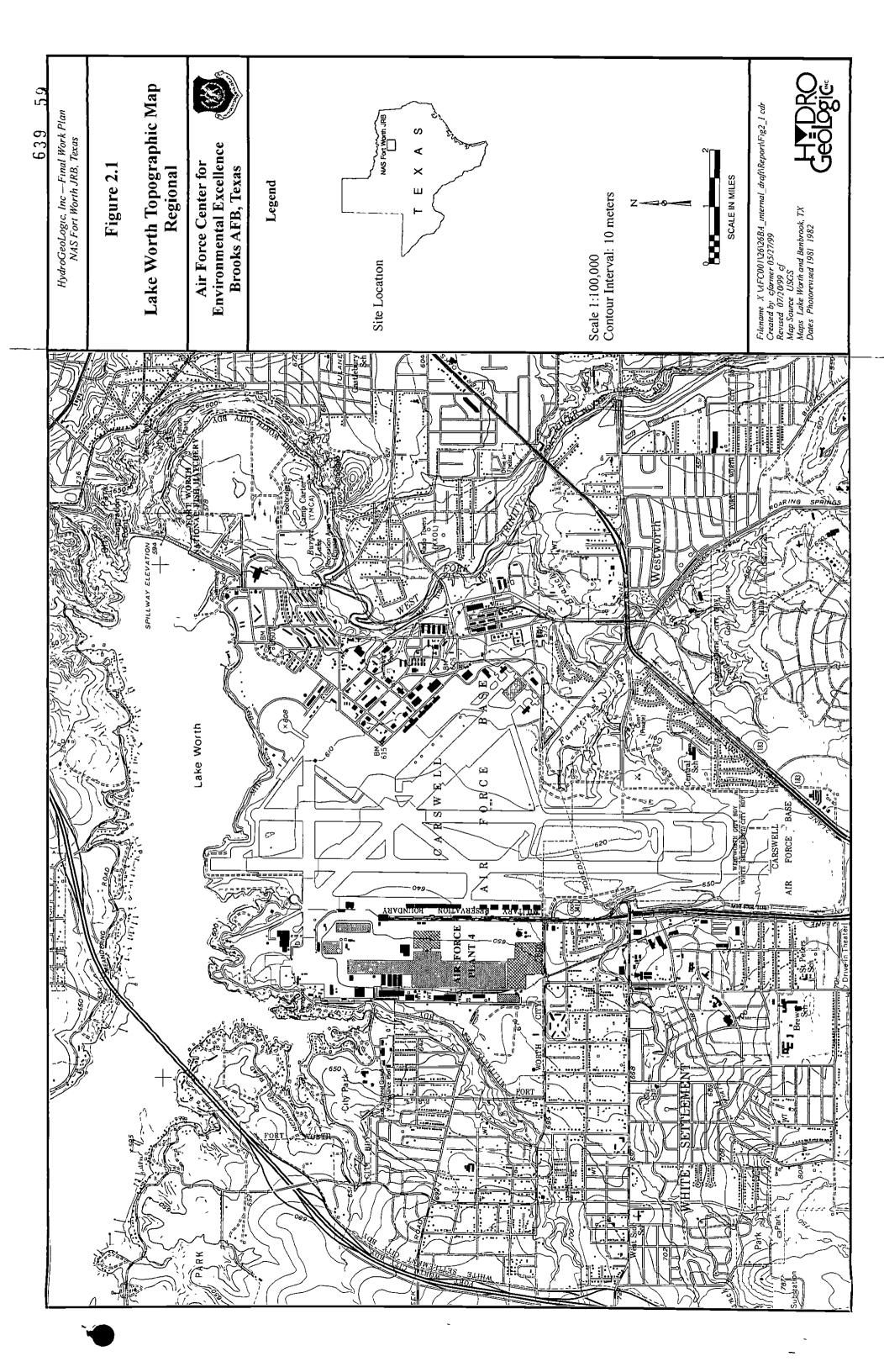
<sup>&</sup>lt;sup>4</sup> Groundwater elevation cannot be determined without top of casing elevation.

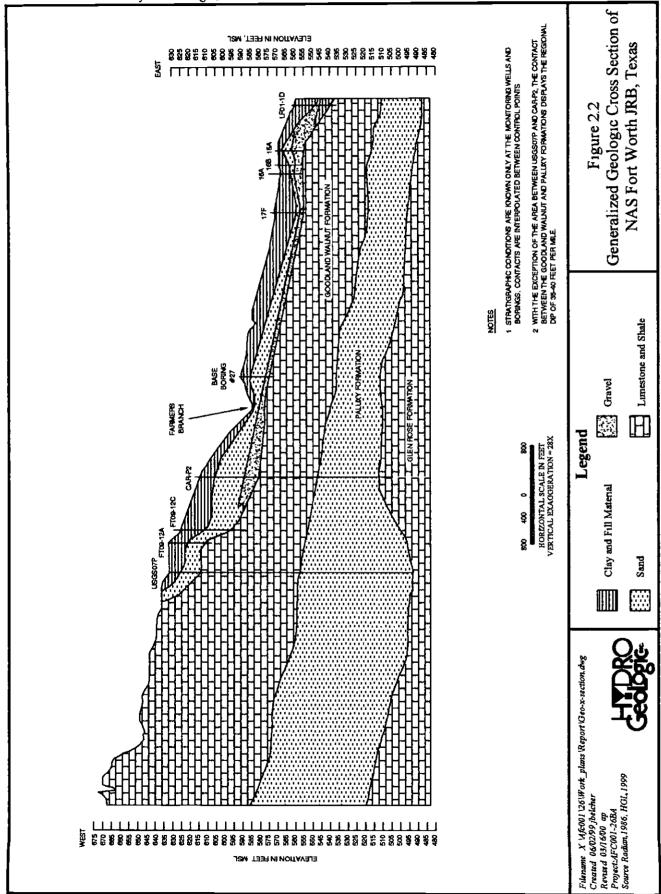
<sup>&</sup>lt;sup>5</sup> Monitoring well contains free product which does not allow for accurate measurement of groundwater level elevations.

<sup>&</sup>lt;sup>6</sup> Monitoring well not gauged.

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Figures





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Geologic Units of

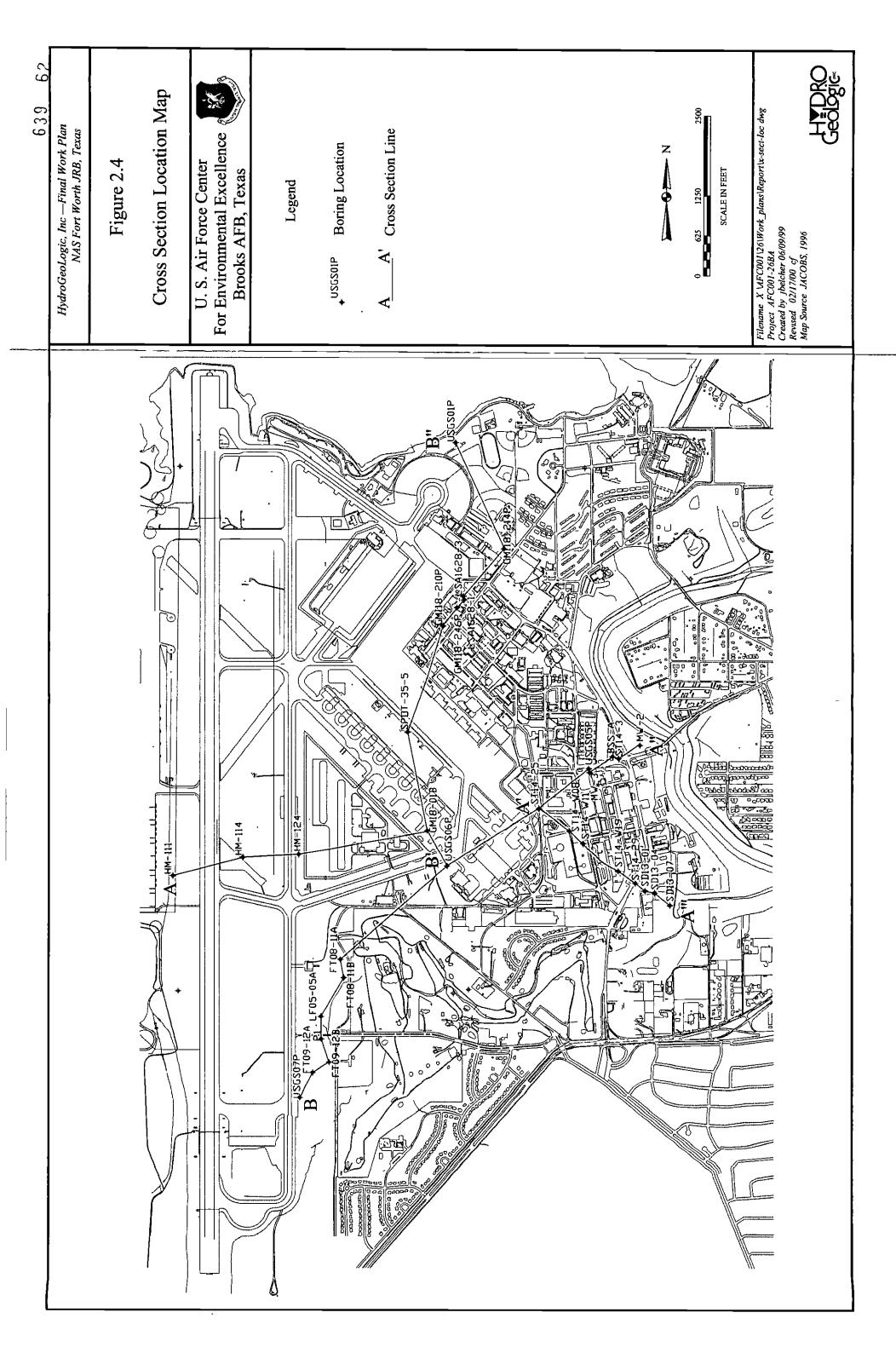
NAS Fort Worth JRB, Texas

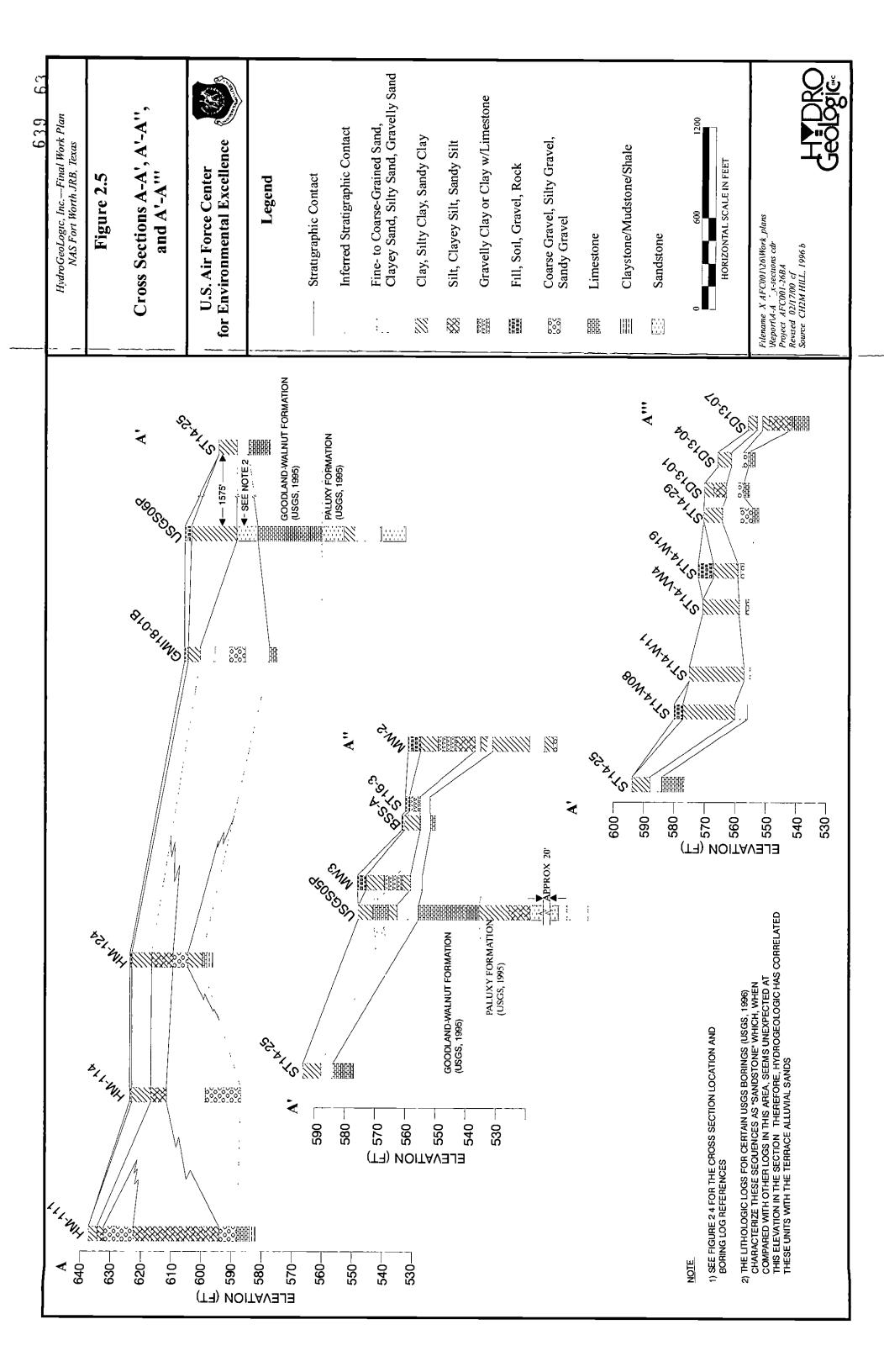
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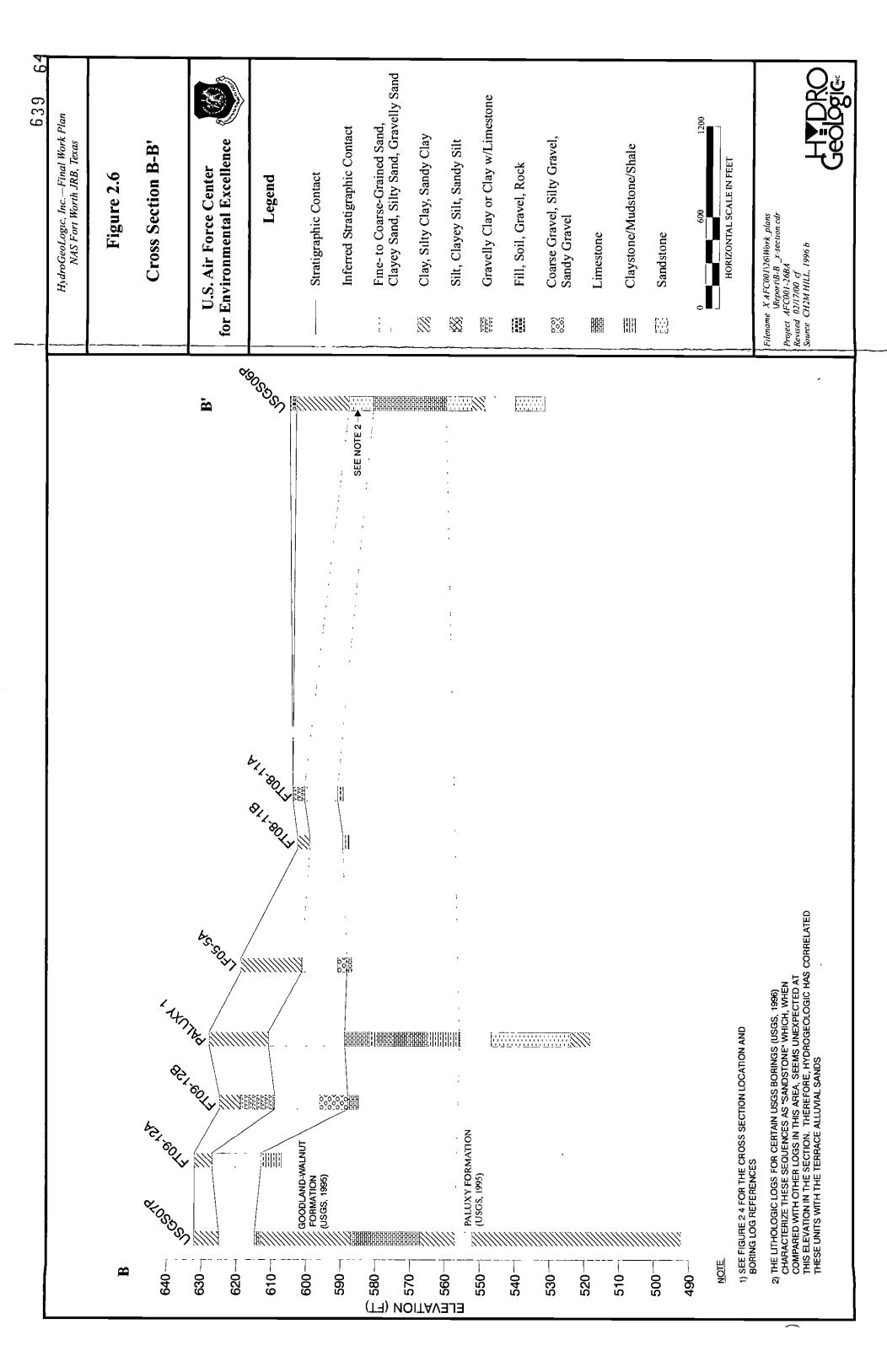
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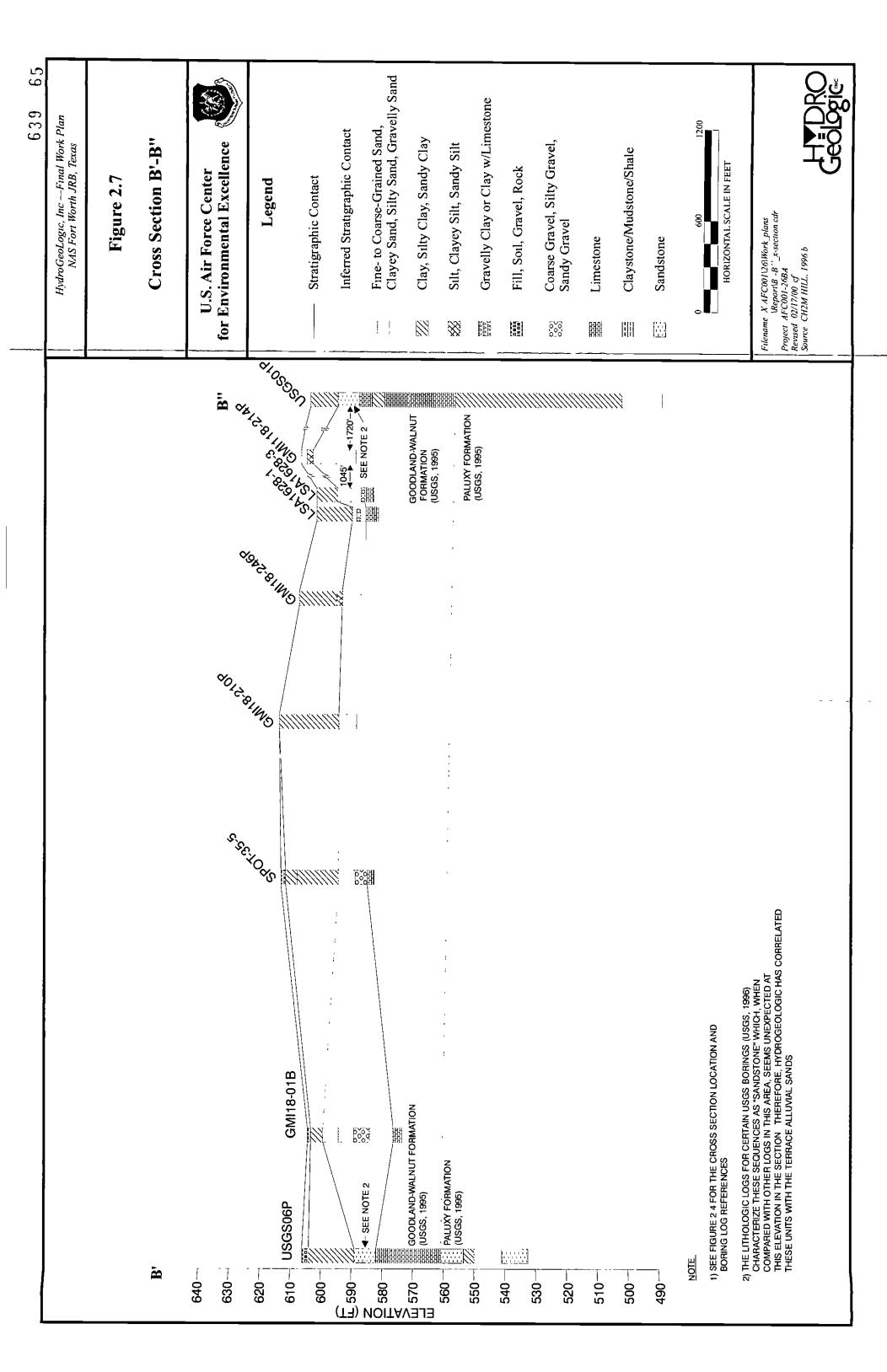
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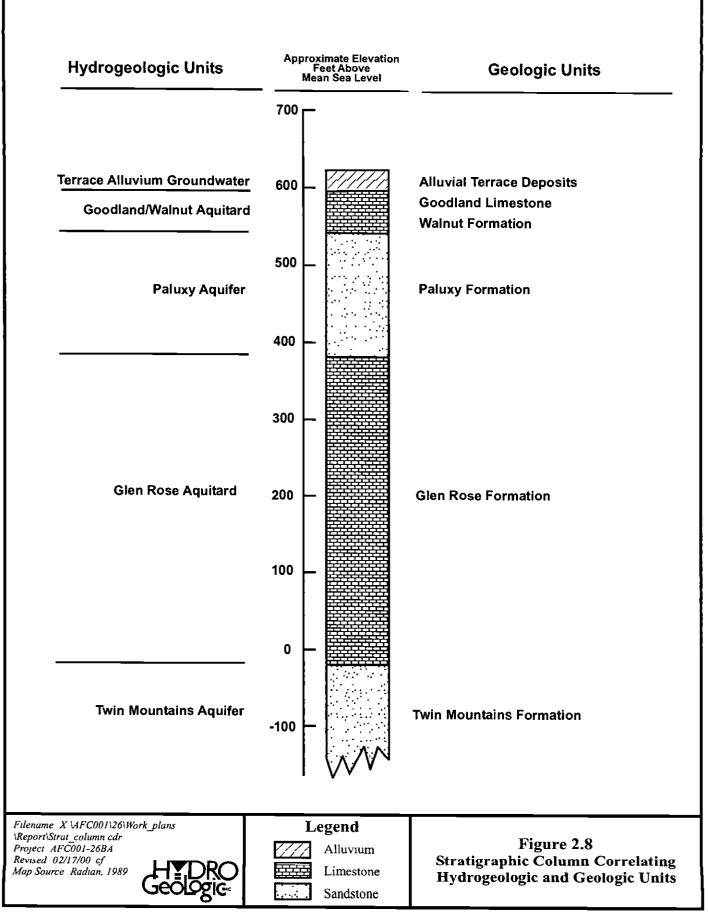
Map Source Radian, 1989

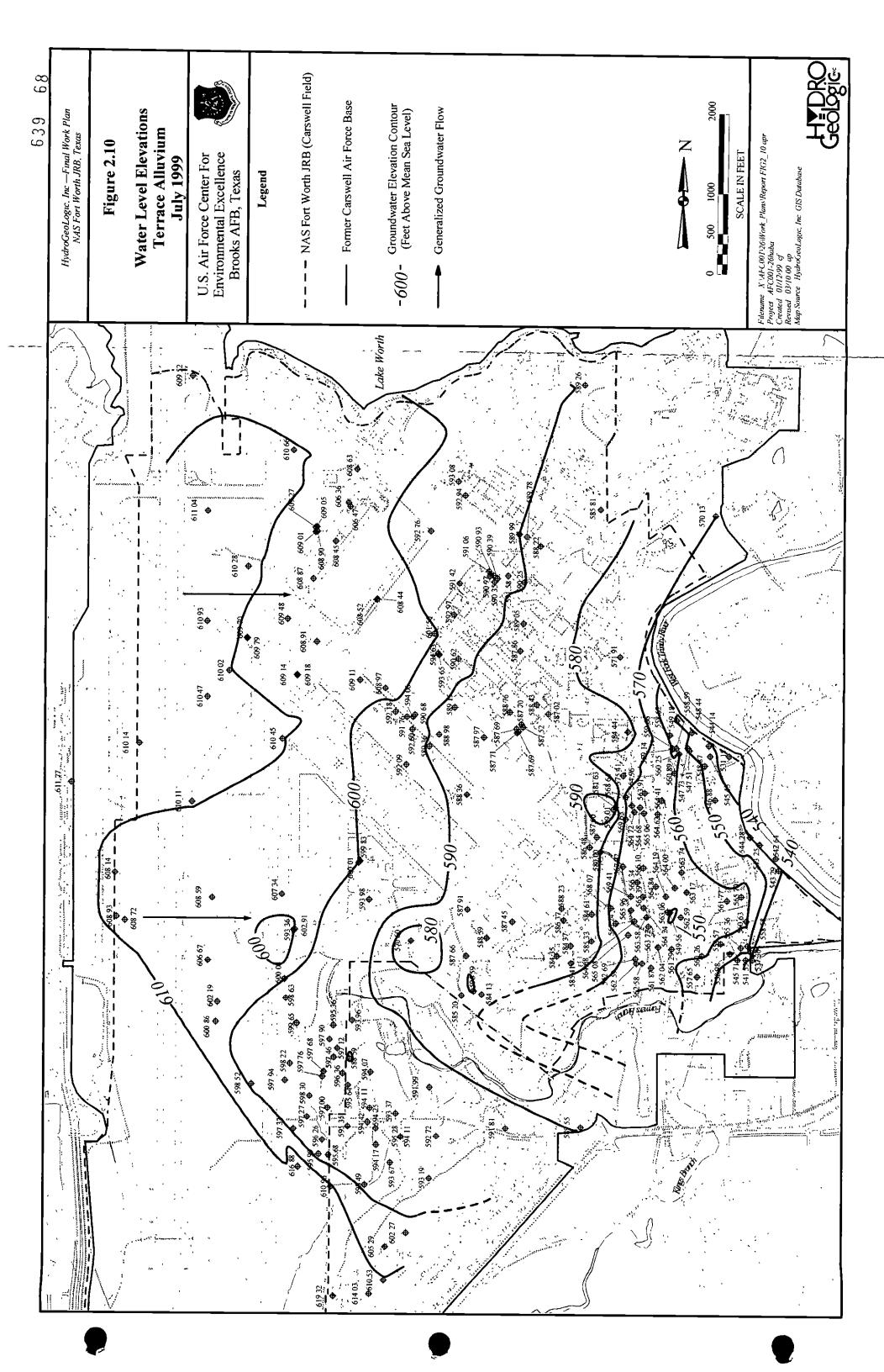


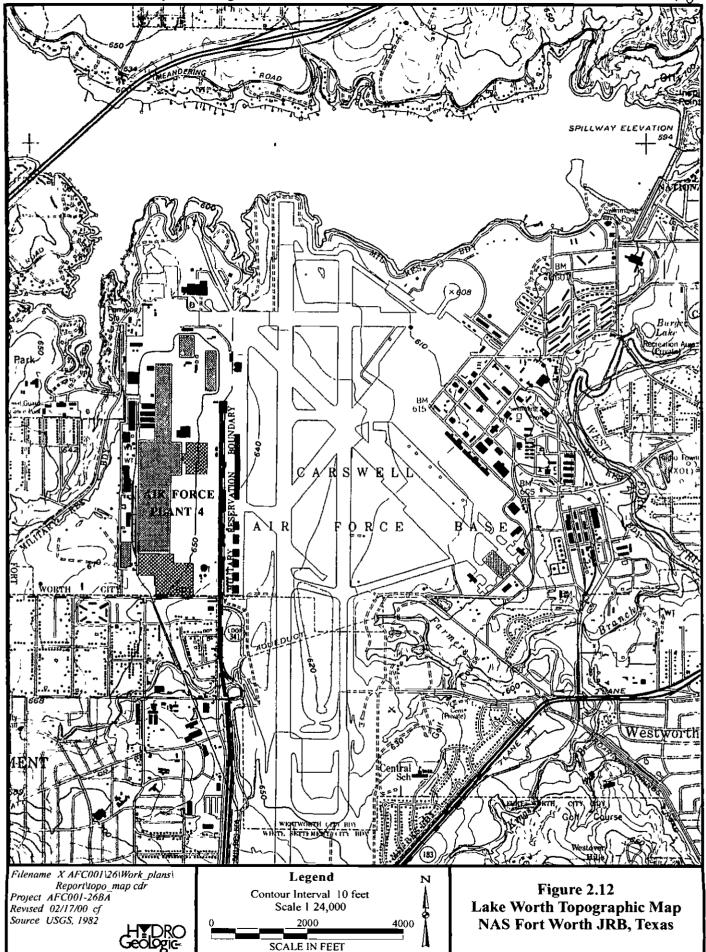




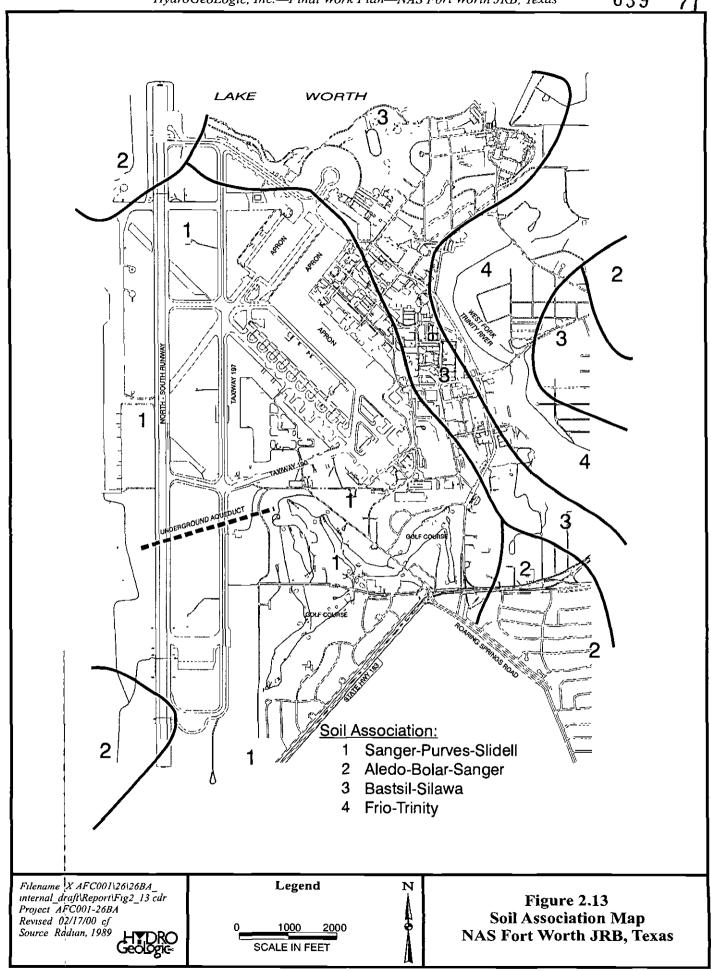








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Section 3

### 3.0 IDENTIFICATION OF DATA GAPS AND PROPOSED SAMPLING **ACTIVITIES**

The following sections present the Applicable or Relevant and Appropriate Requirements (ARARs) for the site, the TNRCC HW-50289 Permit requirements for the site, a summary of the basewide background characterization, a summary of previous investigations at each of the subject sites, the data needs at each of the sites, and the proposed field investigation tasks.

### 3.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs will be considered during the remedy process (per the requirements of Texas Administrative Code [TAC] § 335.562(b)). Federal statutes that will be used for guidance include the Solid Waste Disposal Act, RCRA, the Toxic Substances Control Act, the Safe Drinking Water Act, the Clean Air Act, the Clean Water Act, the Endangered Species Act, the Fish and Wildlife Conservation Act, and the Marine Protection Research and Sanctuaries Act. objective of this project is to obtain closure under the TNRCC RRS Program.

The following requirements comprise the three general types of ARARs:

- Chemical specific requirements are usually health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment.
- Location specific requirements are restrictions placed on the concentrations of hazardous substances or the performance of activities solely because they occur in special locations.
- Action specific requirements are usually technology based requirements or limitations on actions taken with respect to hazardous wastes.

Tables that present a preliminary list of ARARs to be considered during this investigation are included as Appendix B. As more information becomes available through project activities, the ARARs will be further refined.

### 3.2 PERMIT HW-50289 REQUIREMENTS

As bearer of the TNRCC HW Permit (HW-50289), NAS Fort Worth JRB is subject to regulation under RCRA and the Texas Solid Waste Disposal Act, including the corrective action requirements of RCRA and the Texas Risk Reduction Rules (30 TAC § 335 Subchapter S). The overall objective of this project is to obtain closure under the TNRCC RRS program. Specific RFI requirements of the HW-50289 permit are as follows:

Provision VIII.A.2.b (1) requires a hydrogeologic assessment of the area to characterize the uppermost aquifer beneath the unit. Data on the strata encountered, saturated intervals, and groundwater flow must be collected. Soil samples from borings must be taken continuously from the surface to a depth of 20 feet and then at 5-foot intervals thereafter until groundwater is reached. Soil boring samples submitted for chemical analysis must be collected every 5 feet from the surface to the bottom of the boring and be analyzed in accordance with the EPA SW-846 for all Appendix IX constituents, unless a shorter list can be justified.

- Provision VIII.A.2.b (2) requires the installation of a groundwater monitoring system, based on the soil boring program, consisting of a minimum of one background well located hydraulically upgradient of the unit and removed a sufficient distance so as to not be effected by the unit, and at least three wells located on the downgradient perimeter of the unit. The upper 20 feet of the upper flow zone of the uppermost aquifer must be sampled by wells.
- Provision VIII.A.2.b (4) requires the collection of groundwater samples from monitoring wells during three sampling events spaced at 2-month intervals. These samples will be analyzed in accordance with EPA SW-846 for all Appendix IX constituents, unless a shorter list can be justified.

### 3.3 CHARACTERIZATION OF BACKGROUND CONDITIONS

Jacobs Engineering conducted a basewide background study in 1996 to establish background concentrations of 24 inorganic constituents in surface soil, subsurface soil, alluvial terrace groundwater, surface water, and sediments at NAS Fort Worth JRB. The study quantified groundwater concentrations in the alluvial terrace using both low stress and bailer sampling techniques. All samples were collected and analyzed for metals, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). Sampling locations were selected based on their proximity to known sources of contamination and contaminated media. Inorganic sample results were not included in the statistical determination of background concentrations at locations where organic compounds were detected above detection limits (Jacobs, 1998).

Results of this background study for all media are presented in Tables C.1 through C.6 of Appendix C. The background study used the tolerance interval method to estimate upper tolerance limits (UTLs) of the distribution of each constituent in the background data population. The  $UTL_{95,95}$  values listed in the tables are the values that, with 95 percent confidence, will exceed 95 percent of the background concentrations. This RFI will use the  $UTL_{95,95}$  values listed in Appendix C as background values for all investigative work (Jacobs, 1998).

### 3.4 IDENTIFICATION OF DATA NEEDS

The objective of this investigation is to determine if hazardous constituents have been released to the environment from the subject sites. If a release has been confirmed, the investigation will continue in order to determine the nature and extent of the contamination.

Four primary objectives have been identified for this project, and are summarized in Table 3.1. These objectives are as follows:

- Fill data gaps with respect to the hydrogeological regime at several of the sites. This will be accomplished by installing monitoring wells at selected sites to determine depth to bedrock, the lithologic unit that represents bedrock, and depth to groundwater.
- Determine if subsurface anomalies exist in select areas using geophysical methods.
- Determine if a release from the units has occurred. Soil borings will be completed to the top of the water table using direct push technology (DPT) methods at each site, and the soil will be sampled every 5 feet to determine if a release has occurred. At select upgradient and downgradient locations, borings will be continued to bedrock and completed as groundwater monitoring wells using hollow-stem auger (HSA) drilling methods. Additional borings will be advanced and sampled as necessary to ensure that the horizontal extent of any potential contamination is evaluated.
- If contamination is encountered, the nature and extent of the contamination will be characterized. This will be accomplished by defining the vertical and lateral extent of chemicals that exceed background or RRS1. Field methods that will be utilized include soil boring installation, monitoring well installation, and groundwater sampling from new and existing monitoring wells.

### 3.5 FIELD INVESTIGATION TASKS

The proposed field tasks described in the following sections will be conducted to achieve the project objectives listed in Section 3.4. As previously noted, each of the SWMUs and AOCs received various types and amounts of hazardous wastes throughout their respective periods of operation. The field tasks described in the following sections were chosen by evaluating the type and purpose of data required to characterize the various SWMUs and AOCs.

The following sections describe historic investigative activities performed at each SWMU or AOC and all investigative activities proposed by HydroGeoLogic. Suggested soil boring and monitoring well locations may change due to site-specific conditions such as utilities, fences, and structures encountered during the field implementation.

### 3.5.1 SWMUs 19, 20, and 21

### 3.5.1.1 Site Investigation History

Several SIs and remedial actions are associated with SWMUs 19, 20, and 21. Summaries of these activities are presented in the following sections.

### 3.5.1.1.1 1983 Phase I Investigation

In 1983 CH2M Hill conducted a Phase I Investigation in order to identify potential problems associated with contaminants at the former CAFB. During a base visit investigators observed unburned fuel on the ground inside SWMU 19 (Fire Training Area No. 2), indicating incomplete consumption of fuels used during fire training exercises. As a result, SWMU 19 received a high hazard assessment rating, and the site was recommended for Phase II Investigation (CH2M Hill, 1984).

### 3.5.1.1.2 1985 IRP Phase II, Stage I Investigation

In 1985 Radian conducted an IRP Phase II, Stage 1 investigation at SWMU 19. SWMU 19 was operating as an active fire training area at the time of the investigation. This investigation did not include SWMU 20 or SWMU 21. The Stage 1 investigation consisted of geophysical surveys (electromagnetic profiling [EMP] and vertical electrical sounding [VES]), soil sampling using a hand auger, the installation of upper zone monitoring wells, and the collection of surface water samples.

During their initial assessment of the site, Radian observed a breach in the inner berm surrounding the fire pit. In addition, Radian observed a drainage ditch which carried overflow from the fire training area to Farmers Branch Creek. The location of the ditch is unknown. A geophysical survey was conducted using an EMP device within a 560 by 280 foot grid surrounding SWMU 19. The areas at the center of the training area and in the southwest corner were exempted from the geophysical survey due to interference from metal structures. EMP readings were taken every 20 feet. No significant anomalies were detected during the geophysical surveys using the EMP, with the exception of an area of high conductivity northeast of the burn pit which corresponded with drainage coming from the pit. Geophysical surveys were conducted using a VES device northwest and southeast of the outer bermed area of SWMU 19. No significant anomalies were detected (Radian, 1986a).

Three upper zone monitoring wells, FT09-12A, FT09-12B, and FT09-12C, were installed during the 1985 Phase II investigation. In addition, one hand-augered soil boring (12F) was installed in the center of SWMU 19. Monitoring well and soil boring locations are depicted on Figure 3.1. Soil samples were collected during the installation of the monitoring wells and boring 12F, and analyzed for metals (unspecified method), oil and grease (unspecified method), and VOCs (EPA methods 601 and 602). Soil samples were collected for analysis based on the depth, location, and the presence of water. The specific sampling intervals for each location were not reported. Surface and subsurface soil analytical results are presented in Tables 3.2 and 3.3 respectively. Results of the surface soil analyses showed concentrations of several metals above background in samples collected from boring 12F. Among them, concentrations of lead and selenium exceeded the MSCs. Several VOCs were also detected in the surface samples collected from boring 12F, including high concentrations of TCE and benzene. In addition, results of the soil analyses revealed high concentrations of oil and grease in surface samples collected in boring 12F (up to 17,000 milligrams per kilogram [mg/kg]) (Radian, 1986). Results of the surface soil analyses at SWMU 19 showed significant levels of petroleum and chlorinated solvent contamination as a result of the fire training exercises at SWMU 19. Although no surface soil contamination was reported in the borings FT09-12A, FT0912B, and FT09-12C, it is not known whether surface samples from these borings were collected.

Subsurface soil results indicate elevated concentrations of lead, mercury, selenium and silver in boring 12F. Concentrations of lead, mercury, and selenium exceeded the MSCs. Concentrations of silver and selenium were also detected above background in the subsurface samples collected from borings FT09-12A, FT09-12B, and FT09-12C. These concentrations of selenium also exceeded the MSC (Radian, 1986). Several VOCs were detected above reporting limits in the subsurface samples collected from boring 12F. Among them, ethylbenzene and toluene concentrations exceeded the MSCs. In addition, oil and grease was detected in boring 12F at concentrations as high as 11,000 mg/kg at 8 feet below ground surface (bgs). Concentrations of ethylbenzene and toluene were detected above reporting limits in the sample collected from boring FT09-12B at 14 to 15 feet bgs. A significant detection of oil and grease (700 mg/kg) was also detected in boring FT09-12B at this same interval.

Groundwater samples were collected in February and March 1985 from monitoring wells FT09-12A, FT09-12B, and FT09-12C. Samples were analyzed for metals (unspecified method), organic indicators (unspecified method), and VOCs (EPA methods 601 and 602). Groundwater analytical results are presented in Table 3.4. Mercury was detected above background in groundwater collected from monitoring well FT09-12B during the February sampling event. No other metals were detected above background. Oil and grease was detected during the February 1985 event at concentrations as high as 89 milligrams per liter (mg/L) in FT09-12C. In addition, significant concentrations of chlorinated solvents were detected in the groundwater sampled from both upgradient and downgradient monitoring wells at SWMU 19 during both sampling events (Radian, 1986).

Surface water samples were collected in January 1985 (shortly after a fire training event) and again in February 1985. The surface water sample location is depicted on Figure 3.1. Surface water samples were analyzed for metals (unspecified method), organic indicators (unspecified method), and VOCs (EPA methods 601 and 602). Surface water analytical results are presented in Table 3.5. The January 1985 surface water samples contained concentrations of barium, chromium, and mercury above background, and concentrations of arsenic, cadmium, and lead above both the background and MSC. Silver had a detection limit above the background concentrations and therefore, may have exceeded background levels. In addition, selenium had a detection limit above both the background and the MSC and therefore, concentrations may have exceeded background and MSC values. January 1985 surface water samples also contained high concentrations of oil and grease (84,000 mg/L) and total organic carbon (TOC) (50,000 mg/L). The February 1985 surface water samples contained concentrations of mercury above background concentrations. Cadmium and silver had a detection limit above background concentrations and therefore, may have exceeded background levels. In addition, arsenic, lead and selenium had a detection limit above the background and the MSC and therefore, concentrations may have exceeded both the background and the MSC. Results of the February surface water analyses revealed much lower concentrations of oil and grease and TOC than in January (Radian, 1986).

As a result of the 1985 IRP Phase II, Stage 1 investigation, Radian concluded that: (1) organic contamination was greatest in the soil at the center of SWMU 19, (2) the surface water quality was

highly variable and corresponded directly to the performance of fire training exercises, and (3) volatile compounds in surface water were lost to the atmosphere within a few days and within a short distance from the fire training area. As a result, additional investigations to delineate the soil and groundwater impacts were recommended (Radian, 1986).

### 3.5.1.1.3 1988 IRP Stage II Remedial Investigation/Feasibility Study

In 1988 Radian conducted an IRP Stage 2 RI/FS at SWMU 19 in order to determine the magnitude and extent of contamination identified in the Stage 1 investigation (Radian, 1989). This investigation did not include SWMU 20 or SWMU 21. Investigation activities included the installation of two additional monitoring wells (FT09-12D and FT09-12E), the installation of five additional boreholes (12G through 12K), and the collection and analyses of soil and groundwater samples (Radian, 1989). Soil boring and monitoring well locations are presented in Figure 3.1.

Soil samples were collected for analysis during the installation of monitoring wells FT09-12D and FT09-12E and soil borings 12G through 12K based on the depth, location, and the presence of water. The specific soil sampling intervals for each location were not reported. Soil samples were analyzed for heavy metals (EPA method 3050/6010), total petroleum hydrocarbons (TPH) (EPA method 3550/418.1), VOCs (EPA method 5030/8240), and SVOCs (EPA method 5030/8270). The 1988 soil analytical results are presented in Table 3.6.

Concentrations of metals appeared to be distributed fairly randomly in the samples collected throughout the soil borings. Eleven of the twenty three metals detected at the site were present at concentrations which exceeded background levels. Nine of these metals exceeded MSCs at the site, including aluminum, antimony, arsenic, cadmium, chromium, lead, magnesium, potassium and selenium.

Concentrations of several petroleum related VOCs and SVOCs were present above detection limits in samples collected from all of the borings. Benzene (0.54J mg/kg) was detected above the MSC in the sample collected from boring 12I at a depth of 9 feet bgs, and 2-butanone was detected above the MSC throughout boring 12H. Of the SVOCs detected at the site, bis(2-ethylhexyl)phthalate concentrations were above the MSC in the samples collected from borings 12H at depths of 9, 14, and 19 feet bgs, and in boring 12I at a depth of 4 feet bgs. In addition, 4-methyl phenol was detected above the MSC in 12H at 4 feet bgs and in 12I at 9 feet bgs. Concentrations of TPH were detected in the samples collected from borings FT09-12E, 12H, 12I, 12J, and 12K. These detections of TPH significantly exceeded the TNRCC action level of 500 mg/kg for coarse grained soils in borings 12H (up to 5,760 mg/kg) and 12I (up to 1,250 mg/kg)(Radian, 1989a).

Groundwater samples were collected during February/March and April, 1988 from all five wells at the site (FT09-12A through FT09-12E) and analyzed for: water quality parameters fluoride, chloride, nitrate, and sulfate (using methods E340.2, E325.3, E353.1 and E375.4, respectively); metals by method E200.7; purgeable halocarbons by method E601; purgeable aromatics by method SW8020; TPH by method E418.1; and extractable priority pollutants by method E625 (Radian, 1989). A summary of groundwater analytical results is presented in Table 3.7.

Metal concentrations in groundwater seem to be fairly randomly distributed. Nineteen of the twenty four metals detected were present at concentrations above established background levels in samples collected from all five monitoring wells. Of these, 12 metals were present at concentrations above the MSCs in both upgradient and downgradient wells (Radian, 1989).

Eight purgeable halocarbons were detected in groundwater samples collected from the five monitoring wells. Of these eight, three purgeable halocarbons, tetrachloroethene (PCE), TCE and vinyl chloride, were detected at concentrations above the MSCs for both sampling events. PCE was detected in concentrations above the MSC in the groundwater sampled from monitoring well FT09-12B, and TCE was detected at concentrations above the MSC in groundwater sampled from monitoring wells FT09-12B and FT09-12D. Vinyl chloride was present at concentrations above the MSC in groundwater sampled from monitoring well FT09-12C for both sampling events.

Four purgeable aromatics were detected in groundwater at the site. Toluene was detected above the method detection limits in all five monitoring wells. Concentrations of 1,4-dichlorobenzene exceeded the method detection limits in groundwater sampled from monitoring wells FT09-12E in March 1988, and in FT09-12C and FT09-12E in April, 1988. Concentrations of 1,2-dichlorobenzene exceeded the method detection limits in monitoring well FT09-12C in April 1988. Benzene exceeded method detection limits in FT09-12E in April 1988 (Radian, 1989).

As a result of the IRP Stage 2 RI/FS at SWMU 19, Radian concluded that: (1) the major contaminants of concern in the soil are petroleum hydrocarbon compounds, (2) the principal groundwater contaminant in the upper zone, both upgradient and downgradient of the site, is TCE, and (3) boreholes directly beneath the site did not detect groundwater, thus reducing the opportunity for contaminants to enter the groundwater and move downgradient (Radian, 1989).

### 3.5.1.1.4 1989 Preliminary Review/Visual Site Inspection

In 1989, A.T. Kearney conducted a Preliminary Review (PR)/Visual Site Inspection (VSI) of SWMUs 19, 20 and 21. The fire training area was still operational during the PR/VSI. During this inspection, an oil and/or fuel slick was visible on the ponded water in the burn pit located in the center of SWMU 19. In addition, a burn pan located to the south of the pit contained rain water with an oily layer at the surface. Soil adjacent to the SWMU 20 AST and it's ancillary pump and piping was extensively stained, indicating spills (possibly from the addition of wastes to the tank). General management practices of this site during the VSI were considered to be poor. As a result, A.T. Kearney concluded that the potential for release from SWMUs 19 and 20 was high. The SWMU 21 UST was also evaluated during the PR/VSI, but the structural integrity of the tank was not confirmed due to the tank's location beneath the ground surface. A.T. Kearney recommended that an RFI be conducted for SWMUs 19, 20, and 21 (A.T. Kearney, 1989).

### 3.5.1.1.5 I993 Remedial Actions

In 1993 Dames & Moore initiated remedial activities at SWMUs 19 and 20, which included: (1) the analysis and removal of the liquid contents of the AST (SWMU 20), (2) the removal of the AST, its concrete pad and associated piping, (3) the installation of 12 soil borings, (4) the

collection of soil, surface water, and groundwater samples for analyses, (5) the removal and remediation of soil from SWMUs 19 and 20, and (6) the installation of a clay liner in excavated areas and the installation of backfill using treated soils (Dames & Moore, 1995). All sampling analyses performed during this investigation were conducted by Inchape Testing Services (ITS). The ITS data was rejected based on laboratory quality control (QC) concerns, and therefore, is provided for informational purposes only. In addition, SWMU 21 was reported to have been removed from the site prior to this investigation by an unknown off-base contractor. No documentation of the removal efforts has been located.

On April 21, 1993, the 8,500 gallon waste fuel AST (SWMU 20) was emptied of 3,054 gallons of waste fuel, evacuated, rinsed, and shipped off site for destruction. Associated rubble and debris, along with the fire ring and piping were transported off site for disposal. On April 26, 1993 the 25 steel dumpsters within SWMU 19 were transported off site for destruction (Dames & Moore, 1995).

Preliminary soil samples (DFT1 through DFT30) were collected at 0-3 feet bgs from nine locations within SWMU 19. Three additional soil samples (AST-1 through AST-3) were collected within SWMU 20 at 0.5 feet bgs. Sample locations are depicted on Figure 3.1. Soil samples were analyzed for TPH (EPA method 418.1) and benzene, toluene, ethylbenzene, and xylenes (BTEX) (EPA method 8020). Soil analytical results are summarized in Table 3.8.

High concentrations of TPH (up to 6,100 mg/kg) were detected in all three soil samples collected from the SWMU 20 area. In addition, high concentrations of TPH (up to 13,000 mg/kg) were detected in the soil samples collected from the inner bermed area of SWMU 19. Lower concentrations of TPH (up to 3,100 mg/kg) were detected in soil samples collected from the outer bermed area. BTEX concentrations were below detection limits for all three soil samples collected from the soil within SWMU 20. Concentrations of BTEX ranged from below detection limits to 17.1 mg/kg in the samples collected within the outer bermed area of SWMU 19, and ranged from below detection limits to 25.5 mg/kg within the inner bermed area of SWMU 19. (Dames & Moore, 1995).

One surface water sample (with one duplicate) was collected and analyzed for TPH (EPA method 418.1) and BTEX (EPA method 8020). The location of this surface sample is depicted on Figure 3.1. The surface water sample contained 1.1 mg/L of TPH and was below detection limits for BTEX (Dames & Moore, 1995).

The top 3 feet of soil (8,894 cubic yards) was excavated from SWMUs 19 and 20 and transported to a biocell treatment area just north of Building 1050 and south of Hangar 1041 for treatment. After soils were excavated and transported to the biocell, five verification soil samples (VFT-28 through VFT-32) were collected from the excavated area inside SWMU 19, and two verification soil samples (VAST-4 and VAST-5) were collected from the excavated area inside SWMU 20. All samples were collected at a depth of 3.5 feet below the original surface grade. Sample locations are depicted on Figure 3.1. Soil samples were analyzed for TPH (EPA method 418.1) and BTEX (EPA method 8020). Verification soil analytical results are summarized in Table 3.9.

High concentrations of TPH were detected in soil samples VFT-29, VFT-31, and VAST-4. Concentrations of BTEX were detected in these same samples above the reporting limits. No detections of BTEX were detected above reporting limits in samples VFT-28, VFT-30, VFT-32, and VAST-5 (Dames & Moore, 1995).

Upon direction of the United States Army Corps of Engineers (USACE), a 32-inch thick low permeability compacted clay liner was placed on the bottom of the excavations at SWMUs 19 and 20, and the bioremediated soil was returned to the excavated areas. The soils at SWMUs 19 and 20 were then compacted and regraded prior to returfing. Based upon the activities performed, Dames & Moore concluded that: (1) soils remained at the site above the cleanup goals and (2) based on prior groundwater data, it appeared that deeper impacts exist at the site which may have adversely impacted groundwater quality. As a result, Dames & Moore recommended a health-based risk assessment be performed in order to arrive at reasonable cleanup objectives for the site (Dames & Moore, 1995).

### 3.5.1.1.6 1999 Basewide Quarterly Groundwater Sampling Program

In January 1999, HydroGeoLogic collected groundwater samples from monitoring wells USGS07T and FT09-12C under the basewide quarterly groundwater sampling program. Groundwater was also collected from FT09-12C in April 1999. Monitoring well USGS07T is located upgradient of SWMUs 19, 20, and 21, and monitoring well FT09-12C is located downgradient of SWMUs 19, 20, and 21. Monitoring well locations are presented on Figure 3.1. Groundwater samples were analyzed for VOCs (EPA method 8260B). Analytical results are summarized in Table 3.10.

Analytical results indicated concentrations of chlorinated hydrocarbons in the groundwater sampled both upgradient (USGS07T) and downgradient (FT09-12C) of the site. However, concentrations of petroleum hydrocarbons were detected in the downgradient well (FT09-12C) only (HydroGeoLogic, 1999a, b).

### 3.5.1.1.7 Previous Investigation Summary

The results of previous investigative activities performed by Radian confirmed the presence of metals, petroleum hydrocarbons and chlorinated hydrocarbons in the soil and groundwater at SWMUs 19, and 20. However, soil and groundwater samples were not analyzed for all the parameters needed to adequately characterize the site, and the extent of the soil and groundwater contamination was not delineated. Chlorinated hydrocarbons have been detected in groundwater both upgradient and downgradient of the site. This contamination likely originated from an upgradient source, and is currently being addressed under the investigation of the regional TCE groundwater plume. Additional soil and groundwater samples will be needed to fully confirm and delineate the extent of the contamination at SWMUs 19 and 20.

The remedial activities performed at SWMUs 19 and 20 included the excavation of surface soils, the collection of conformational soil samples at the bottom of each excavation, the installation of a clay layer on top of each excavation, and the backfilling of bioremediated soils. However, contaminated soils were only excavated to a depth of three feet bgs, even though prior and conformational soil analyses indicated the presence of additional contamination in the subsurface.

The results of all conformational and bioremediated soil analyses were rejected as unreliable. In addition, the integrity of the clay layer has not been confirmed. As a result, additional soil and groundwater samples will be needed to confirm that the surface soils were remediated and that subsurface soil contamination is not reaching groundwater beneath the site.

SWMU 21(the 12,000 gallon UST) was reported to have been removed by an off-base contractor sometime between 1989 and 1993. An extensive records search has been performed which included review of base site assessments, remedial action reports, TNRCC UST inventories, site walks, and interviews with base personnel; however, no documentation pertaining to the actual removal of SWMU 21 has been obtained. Additional investigative activities will be necessary in order to confirm the removal of the UST, and accurately characterize this site.

### 3.5.1.2 Proposed Activities

Proposed investigation activities at SWMUs 19, 20, and 21 include a metal detection survey, soil boring installations, soil sampling, monitoring well installations, and groundwater sampling from new and existing monitoring wells. A summary of proposed field activities is presented in Table 3.11.

Before any intrusive activities occur at the site, a metal detection survey will be performed in order to confirm the presence or absence of SWMU 21, the 12,000-gallon UST. This survey will be performed using a Geonics EM61 electromagnetic induction (EM) system. The EM61 is a time domain metal detector that detects both ferrous and non-ferrous metals. The response of an isolated buried metal object is a single, sharply-defined peak, facilitating quick and accurate location of the object. The EM61 is ideal for confirming the presence or absence of a steel UST. In addition, the EM61 is relatively insensitive to nearby cultural interferences such as fences, buildings, and power lines. Although if present, such objects could still obscure the location of a UST.

The metal detection survey will be conducted in and around the documented location of SWMU 21 (Department of the Air Force, 1986). The proposed survey grid is depicted on Figure 3.2. If anomalies associated with a UST are identified at the site, then the UST will be removed. All removal efforts will be proposed and reported under a separate investigation. If the existence of SWMU 21 is not confirmed, the removal of the UST will be assumed as previously reported, and the soil and groundwater investigation will be performed for the fire training area as follows.

A total of 18 soil borings will be advanced in the areas within and surrounding SWMUs 19, 20, and 21. The locations of these borings have been placed to confirm the presence of contamination detected in previous investigations, as well as to more fully characterize the entire fire training area. All borings will be advanced to the top of the water table using DPT and soil samples will be collected in 5-foot intervals from the ground surface to the water table. Figure 3.2 illustrates the proposed soil boring locations.

The analytical results of these samples are intended to characterize the bioremediated surface soils, and delineate the linear and vertical extent of subsurface soil contamination detected during previous investigations. A specific list of the types of wasted handled at SWMUs 19, 20, and 21 are included in Table 1.1. A summary of proposed sampling and analysis is presented in Tables 3.12 and 3.13. Based on the wastes handled at SWMUs 19, 20, and 21 during the time this site was operational, all soil samples will be analyzed for the following reduced list of Appendix IX analyses:

### Appendix IX

SW8260B - VOCs
 SW8270C - SVOCs
 SW6010B - metals
 SW7471A - mercury

Soil analytical results are intended to determine and characterize the extent to which the wastes handled at SWMUs 19, 20, and 21 have been released to the environment. This will be accomplished by attempting to define the vertical and lateral extent of all analytical detections that exceed RRS1 levels.

After receiving analytical results of the soil investigation, a second mobilization will occur to install monitoring wells. Two of the proposed soil boring locations, one location in the northwest corner, and one location in the southeast corner of the site, will be selected for monitoring well locations. A HSA will be used and samples will be logged continuously from the water table until bedrock is encountered. These borings will be completed as monitoring wells in order to more fully characterize the groundwater upgradient and downgradient of the site. The selected locations for monitoring well installation may change based on initial soil analytical results. Proposed monitoring well locations are depicted on Figure 3.2.

Groundwater samples will be collected at the two newly installed wells and at existing wells FT09-12A, FT09-12B and FT09-12C. Although FT09-12D and FT09-12E are downgradient of the site, FT09-12D was not drilled down to bedrock, and the most recent water level data (July, 1999), indicates that the water table does not fall within the screened interval for FT09-12E. Therefore, wells FT09-12D and FT09-12E will not be used during this investigation. A summary of existing monitoring well information is presented in Table 3.14.

Three rounds of bimonthly groundwater sampling will be conducted. Groundwater samples will be analyzed for a reduced list of analyses based on the results of the initial soil investigation. Additional soil borings and or monitoring wells may be installed at a later date if necessary, in order to delineate the extent of any contamination not completely delineated during the initial investigation.

### 3.5.2 SWMU 53

Several previous SIs and remedial actions are associated with SWMU 53 (Storm Water Drainage System). Summaries of several of these investigations are presented in the following sections.

### 3.5.2.1 Site Investigation History

### 3.5.2.1.1 1983 Phase I Investigation

In 1983 CH2M Hill conducted a Phase I Investigation in order to identify potential problems at the former CAFB. During a base visit investigators observed aircraft soap entering the north end of SWMU 53 through a small pipe connected to the nearby airplane washracks (SWMU 49 and SWMU 50). Investigators also noted the presence of petroleum products on the surface of water within the drainage ditch. In addition, investigators noted the presence of a dark zone of fuel or oil saturation and the absence of vegetation along the banks of the drainage ditch. As a result, SWMU 53 received a high hazard assessment rating and the site was recommended for Phase II Investigation (CH2M Hill, 1984).

### 3.5.2.1.2 1985 IRP Phase II, Stage I Investigation

In 1985 Radian conducted a IRP Phase II, Stage 1 investigation at SWMU 53<sup>3</sup>. During the investigation, six hand-augered soil borings were installed (13A through 13F) and three surface sediment samples (13G through 13I) were collected along the northern half of the drainage ditch. Soil borings and sediment samples were collected along the drainage ditch from where it emerged (unlined) east of Haile Drive to where it became lined with concrete as it entered the POL Tank Farm. Figure 3.3 depicts the soil boring and sediment sampling locations. Soil samples were collected for analysis based on the depth, location, and the presence of water. The specific sampling intervals for each location were not reported. All soil samples were analyzed for metals by inductively coupled plasma emissions spectroscopy (ICPES) and oil and grease by an infrared method. The specific analytical methods used were not reported. Surface and subsurface soil analytical results are presented in Tables 3.15 and 3.16 respectively.

All concentrations of metals were detected below the established background concentrations in both the surface and subsurface soil samples collected. Concentrations of oil and grease were detected above the PQL in the majority of the surface samples collected. Among them, the highest concentration of oil and grease in the surface was detected in the sample collected from boring 13F (1,300 mg/kg) at 2 feet bgs. There were no concentrations of oil and grease detected in the samples collected from the subsurface soils, with the exception of boring 13F. Concentrations of oil and grease in boring 13F ranged from 160 mg/kg at 6 feet bgs, to 2,000 at 4 feet bgs. The high concentrations of oil and grease in this boring suggest that water may have pooled in this area prior to entering the concrete-lined portion of the ditch, allowing for infiltration of contaminants into the soil. As a result of this investigation, Radian recommended: (1) dredging the ditch to remove contaminated soil and sediment, (2) installing a liner in the ditch, (3) repairing the pipe that supplies fuel from the Fuel System Shop to the Building 1190 OWS, and (4) directing flow through an OWS prior to discharge into Farmers Branch (Radian, 1986).

In addition to activities conducted at SWMU 53, Stage 1 investigative activities were also performed at nearby SWMU 68 (POL tank farm, formerly Site 17). Investigation activities included the installation of soil borings to bedrock, and the collection of soil and groundwater

<sup>&</sup>lt;sup>3</sup> SWMU 53 was referred to as Site 13 in the 1985 Radian investigation.

samples for analysis from each of the soil borings. Several soil borings (17A, 17B, 17E, and 17H), were located in close proximity or upgradient of SWMU 53. Soil and groundwater results from these soil borings are presented for informational purposes. Soil boring locations are depicted on Figure 3.3.

Soil samples were analyzed for oil and grease by an unreported infrared method. No detections of oil and grease were reported in the surface soils. A summary of subsurface soil analytical results is presented as Table 3.17. Concentrations of oil and grease were detected in the subsurface soil sampled from boring 17A (170 mg/kg) at depths of 9 feet and 14 feet bgs, and from boring 17E (up to 1,300 mg/kg) at depths of 9 and 14 feet bgs.

Groundwater samples were collected from each boring and analyzed for oil and grease (by an infrared method), TOC, and total organic halides (TOX) (Radian, 1986). The specific analytical methods were not reported. A summary of groundwater analytical results is presented in Table 3.18. Oil and grease concentrations were detected in the groundwater sampled from boring 17E at 31,000 mg/L. Concentrations of TOC and TOX remained fairly consistent both upgradient and downgradient of the SWMU 53 drainage ditch.

### 3.5.2.1.3 1988 IRP Stage II RI/FS

In 1988 Radian conducted a RI/FS Stage 2 investigation at SWMU 53. The purpose of the investigation was to determine the magnitude and extent of contamination identified in the Stage 1 investigation (Radian, 1986). Activities performed consisted of the collection and analyses of surface sediment samples. Sediment samples were collected from five locations (13G through 13K) during each of two sampling rounds (March 5 and March 31, 1988) and analyzed for metals (6010), TPH (418.1), VOCs (8240), and SVOCs (8270). Surface soil analytical results are presented in Table 3.19. Three of the sample locations (13G, 13H, and 13I) have the same name as locations sampled in 1985 by Radian. In order to differentiate between the two, 1988 locations will be designated as 13G\*, 13H\*, and 13I\*. Sample locations are depicted on Figure 3.3.

Several metals were detected in the surface samples collected during both sampling events, and concentrations appeared to be distributed fairly randomly. Ten of the twenty three metals detected at the site exceeded background concentrations. Of these, seven metals (arsenic, antimony, barium, cadmium, chromium, lead, and selenium) exceeded the MSCs. TPH was detected in all boring locations during both sampling events. Concentrations of TPH ranged from 34 mg/kg in boring 13K to 3,500 mg/kg in boring 13H\*. Several VOCs were detected in the samples collected during both sampling events from boring 13G. Of these VOCs, concentrations of 2-butanone, 4-methyl-2-pentanone, ethylbenzene, toluene, acetone, and total xylenes exceeded the PQLs. Toluene was also detected above the PQL in the sample collected from boring 13K during the March 31 sampling event. A total of twenty four SVOCs were detected during this investigation. Of these, ten exceeded the PQLs and eight exceeded both the PQLs and the MSCs. Analytical results are summarized in Table 3.19. Concentrations of these VOCs and SVOCs were distributed fairly evenly throughout both sampling events.

Due to the findings of this RI/FS Stage 2 investigation Radian concluded that the trends of increasing or decreasing concentrations between sampling rounds and at different locations in the

drainage ditch may be attributed to conditions of variable stream flow, possible pooling or trapping of contaminants in some segments of the ditch, as well as intermittent discharges of fuels or runoff that would influence the distribution of contaminants. As a result, Radian recommended that the drainage ditch be dredged to remove contaminated soil and sediments, and that a concrete liner be installed in the unlined portion.

In addition to activities conducted at SWMU 53, Stage 2 investigative activities were also performed at nearby SWMU 68. This investigation included a soil gas investigation, the installation of five monitoring wells (17I through 17L), and the collection and analyses of soil and groundwater samples. For the purposes of this report, only soil and groundwater results from monitoring wells (17I, 17J, and 17K) adjacent to SWMU 53 will be discussed. Other monitoring wells in the area could be affected by releases from nearby SWMUs, and will not be sampled during this investigation. Figure 3.3 depicts these monitoring well locations.

A soil gas survey was conducted around the area of SWMU 68. The results of the soil gas survey indicated a large plume of petroleum related VOCs underlying the area of petroleum storage tanks (PSTs) 1156 and 1157. The locations of PSTs 1156 and 1157 are shown on Figure 3.3. Soil samples were collected during the installation of monitoring wells 17I, 17J, and 17K. Soil samples were collected for analyses based on visible evidence of contamination of the soil, organic vapor detections, and/or Draegar tube reactions. If no visible contamination was observed in the soil, the sample was collected at the watertable interface. All soil samples were analyzed for TPH (418.1), VOCs (8240) and lead (7420). No surface soils were analyzed during this investigation. Soil analytical results for subsurface soils are summarized in Table 3.20. Subsurface samples collected during the installation of each monitoring well contained concentrations of lead below background levels. Concentrations of TPH were present above the TNRCC action level of 500 mg/kg in the sample collected from monitoring well 17I. In addition, benzene, toluene, and acetone were detected in the subsurface soils at concentrations well below the practical quantitation limits.

Two rounds of groundwater samples were collected from monitoring wells 17I, 17J, and 17K, and analyzed for metals (200.7), water quality indicators, TPH (418.1), purgeable halocarbons (601), purgeable aromatics (8020), and extractable priority pollutants (625). A summary of groundwater analytical results is present in Table 3.21. Results of the groundwater analyses showed concentrations of several metals and water quality indicators above both background and the MSCs evenly distributed throughout all three wells sampled. Low levels of TPH were detected in the groundwater sampled from monitoring wells 17I and 17J, and a low concentration of TCE was detected in the groundwater sampled from monitoring well 17K during the April, 1988 sampling event. Benzene was detected in concentrations above detection limits in the groundwater sampled from monitoring well 17K and above the MSC in the groundwater sampled from monitoring well 17I. Other purgeable aromatics were detected above PQLs in the groundwater sampled from monitoring wells 17J and 17K.

The results of the SWMU 68 investigation suggest that the presence of petroleum contamination in the southern half of SWMU 53 may be attributed to fuels stored at the POL tank farm.

### 3.5.2.1.4 1993 Remedial Actions

In 1993 Dames & Moore performed remedial activities at SWMU 53 which included the collection and analysis of surface soil and water samples and the replacement of existing structures with a newly lined drainage ditch.

During the remedial actions, the concrete headwall and four asbestos/cement transit pipes were removed from the northern end of the drainage ditch. The pipes were approximately 160 feet in length and, at one time, held telephone conduits. During the removal of the old concrete headwall, unidentified red and black waste materials were discovered in the soil (Dames & Moore, 1995). One foot of soil was excavated from each side of the drainage ditch (668 cubic yards) and was stockpiled for it's eventual transportation and disposal. No analytical results were reported for the excavated soil. In addition, the concrete rubble from the removal of the headwall (240 cubic yards) was disposed of off-site. A new 66-inch reinforced concrete pipe, concrete headwall, and bottom slab were placed at the northern end of the drainage ditch over a layer of clay backfill (Dames & Moore, 1995).

Surface soil samples were collected at 0.5 and 1.5 feet bgs from six locations (DFLD 1 through DFLD 12) within the northern unlined portion of the drainage ditch. However, sample DFLD-2 could not be collected at 1.5 feet bgs due to refusal. Sample locations are depicted on Figure 3.3. Surface soil samples were analyzed for TPH (418.1) and BTEX (8020). Surface soil analytical results are presented in Table 3.22. Concentrations of TPH in the surface soils were detected below TNRCC action levels in several sample locations within the drainage ditch. Low concentrations of BTEX compounds were detected above the PQLs in the surface samples collected from DFLD-5, DFLD-6, DFLD-9, and DFLD-10. One surface water sample (WFLD-1) was collected from the northern end of the drainage ditch and analyzed for TPH (418.1) and BTEX (8020). The location of the surface water sample is presented in Figure 3.3. Results of analyses indicated low concentrations of TPH (14 mg/L) and BTEX concentrations below the detection limits in the surface water (Dames & Moore, 1995). All of the laboratory analyses for this investigation were performed by ITS. ITS data was found to be unreliable and therefore, is provided for informational purposes only.

After the soil and surface water samples were collected, a concrete liner was installed in the excavated portion of SWMU 53.

### 3.5.2.1.5 1993 Oil/Water Separator Investigation

In 1993, Law conducted an investigation of the Building 1190 OWS (SWMU 52), located near the northern end of SWMU 53. During the coarse of the investigation, three soil borings were advanced to the top of the water table and three near-surface soil samples (1190-SB01, 1190-SB02, 1190-SB03) were collected near building 1190. Soil boring locations are depicted on Figure 3.3. Soil samples were analyzed for metals (SW6010/SW3050) and VOCs (SW6240/SW5030). Soil analytical results are presented in Table 3.23. Concentrations of arsenic were detected above both background and the MSC in the sample collected from boring 1190-SB03, and concentrations of lead were detected above both background and the MSC in the samples Concentrations of cadmium exceeded both background and the MSC in the samples

collected from all three soil borings. Concentrations of copper and zinc were detected above background in the sample collected from boring 1190-SB01. Concentrations of selenium were not quantified below the MSC, and therefore, may be present above background and/or the MSC. In addition, concentrations of silver were not quantified below background and therefore, may exceed background. Methylene chloride was the only VOC detected above its PQL. Concentrations of methylene chloride were detected in the samples collected from all three borings (Law, 1995).

During their investigation, Law reported that the OWS system had experienced overflows due to operational problems associated with the pumping mechanism in the system. Overflow from the system and/or surface run off from the adjacent storage area (AOC 15) were suggested as possible sources for surface soil contamination in SWMU 53.

### 3.5.2.1.6 Previous Investigation Summary

The results of previous investigative activities confirm the presence of metals and petroleum hydrocarbon contamination in the soil and groundwater at SWMU 53. However, data gaps still exist at the site. Soil samples were not collected every 5 feet from the surface to the top of the water table along the length of SWMU 53, and groundwater samples were only collected at the southern portion of the site. In addition, soil and groundwater analyses performed during previous investigations were not analyzed for all of the parameters necessary to characterize the site in accordance with the TNRCC permit specifications. Although remedial actions were performed at the northern portion of SWMU 53, verification soil samples were not collected after soil was excavated from the site, and all data collected during the remedial investigation was rejected. As a result, additional investigative activities are necessary in order to more accurately characterize SWMU 53.

### 3.5.2.2 Proposed Activities

Proposed activities at SWMU 53 include: the inspection of the concrete liner running the length of SWMU 53, the installation of 19 soil borings, the installation of one monitoring well, and the collection of soil and groundwater samples for laboratory analyses.

A total of 19 soil borings will be advanced in the area of SWMU 53. Soil borings will be placed approximately every 100 feet, with alternating upgradient and downgradient locations to confirm the presence of contamination detected in previous investigations, as well as to more fully characterize the entire drainage ditch. All 19 soil borings will be advanced to the top of the water table and soil samples will be collected in 5-foot intervals from the ground surface to the water table. Figure 3.4 illustrates the proposed soil boring locations.

The analytical results of these samples are intended to characterize the soil contamination detected in preliminary SIs. A specific list of the types of wastes received at SWMU 53 is included in Table 1.1. A summary of the proposed sampling and analysis is presented in Tables 3.12 and 3.13.

If the concrete liner within SWMU 53 displays cracks, gaps, or deteriorated seams then additional soil borings will be advanced through these areas and soil samples collected from beneath the liner. Based on the wastes handled at SWMU 53, all soil samples will be analyzed for the following reduced list of Appendix IX analyses:

### Appendix IX

SW8260B - VOCs
 SW8270C - SVOCs
 SW6010B - metals
 SW7471A - mercury

Soil analytical results from SWMU 53 are intended to characterize the nature and extent of wastes released into the environment.

After receiving analytical results from the soil investigation, a second mobilization will occur to install monitoring wells. One soil boring location on the southeast edge of SWMU 53 will be selected for a monitoring well location. HSA will be used and samples will be logged continuously from the water table until bedrock is encountered. The well will be used to more fully characterize groundwater downgradient of the site. The selected location for the monitoring well may change based on the initial soil analytical results. The proposed monitoring well location is depicted in Figure 3.4.

In addition to the soil investigation, a groundwater investigation will be performed at SWMU 53. Groundwater samples will be collected from five existing wells ST14-W08, ST14-W09, ST14-W12, 17I, and 17J; and from the newly installed monitoring well. Although monitoring wells ST-25 and 17K are near SWMU 53, recent water level data indicates that the water table in these wells does not fall within the screened intervals (HydroGeoLogic, 1999c). A summary of existing monitoring well information is presented in Table 3.24.

Three rounds of bimonthly groundwater sampling will be conducted. Groundwater samples will be analyzed for a reduced list of Appendix IX analyses based on the results of the initial soil investigation. If necessary, additional soil borings and/or monitoring wells may be installed at a later date in order to further delineate any contamination encountered during the initial investigation.

### 3.5.3 AOC 17

### 3.5.3.1 Site Investigation History

To date there have been no investigative activities conducted for AOC 17. Historic aerial photographs of the site indicate a possible former landfill location (see Figure 1.8). Current photographs of the site are presented in Figure 1.9.

### 3.5.3.2 Proposed Activities

Proposed field activities include the following:

- conduct a geophysical investigation to identify any potential anomalies that may indicate the presence of a former landfill,
- install soil borings for visual observation and chemical analysis,
- install temporary piezometers to determine groundwater flow direction,
- install monitoring wells, and
- collect and analyze soil and groundwater samples to determine the nature and extent of any contamination at AOC 17.

In order to confirm the presence or absence of a former landfill at AOC 17, a geophysical investigation will be conducted at the site. Two geophysical methods will be used during the geophysical investigation: an EM method and a magnetic method. These surveys will be conducted to evaluate the extent of the former landfill (if present) by identifying soil disturbances, and locating metallic objects, such as tanks, pipes, drums, etc. The EM survey will measure the electrical conductivity of the subsurface, and will be conducted using a Geonics EM31 and a digital data recorder. The magnetic survey will be performed with a Gem Systems GSM-19 magnetometer/gradiometer (or equivalent). The magnetometer/gradiometer can detect variation in the subsurface due to ferromagnetic materials by measuring the total magnetic field intensity and the vertical magnetic gradient. Measured geophysical survey data will be plotted and contoured for analysis. The extent of the disturbed soils may indicate the boundary of the former landfill.

A minimum of seven soil borings will be advanced at AOC 17 using a DPT. The exact location of the borings will be determined based on the results of the geophysical survey. Three borings will be advanced to the water table and four borings will be advanced to a depth of at least 10 feet below groundwater or to bedrock, for the purpose of installing piezometers. All soil samples will be collected at 5-foot intervals from the ground surface to the water table. The purpose of these borings will be to evaluate the extent of the landfill (if present) and to delineate the extent of contamination associated with AOC 17. Figure 3.5 illustrates proposed soil boring locations. Continuous cores will be used to evaluate the physical characteristics of the soil and/or waste. Soil samples will be collected at 5-foot intervals from the ground surface to the water table, and submitted for chemical analyses. As there is no historic chemical data at AOC 17, all soil samples will be analyzed for the following full Appendix IX suite.

### Appendix IX

- SW8260B VOCs
   SW8270C SVOCs
- SW8080A organochlorine pesticides and polychlorinated biphenyls (PCBs)
- SW8141A organophosphorus pesticides
- SW8151A chlorinated herbicides
- SW8280A dioxins and furans
- SW9012A cyanide

- SW9030A sulfide
- SW6010B trace elements (metals)
- SW7471A mercury

The proposed analyses for the site are summarized in Tables 3.12 and 3.13.

Although groundwater flow at NAS Fort Worth JRB is generally from west to east across the base, localized variations in groundwater flow directions exist. There is one downgradient monitoring well near AOC 17 (GMI-22-05M). Little groundwater flow information is available for this area. Four soil borings will be converted into temporary piezometers, and used to evaluate the groundwater flow direction prior to the installation of any monitoring wells. Proposed piezometer locations are depicted on Figure 3.5.

If contamination is detected during the soil investigation, a second mobilization will occur to install monitoring wells. After groundwater flow patterns have been established, four 2-inch monitoring wells will be installed using a HSA. Each of these borings will be completed 1-foot into the bedrock. The monitoring well pattern will consist of one upgradient well and three downgradient wells.

Three rounds of bimonthly groundwater sampling will be conducted. Groundwater samples will be analyzed for a reduced list of Appendix IX analyses based on the results of the initial soil investigation. Additional soil borings and/or monitoring wells may be installed at a later date to delineate the extent of any contamination found to be originating from AOC 17.

### 3.5.4 AOC 18

### 3.5.4.1 Site Investigation History

To date there have been no investigative activities conducted for AOC 18 (Suspected Former Fire Training Area A). Historic aerial photographs of the site indicate a possible former fire training area (see Figure 1.10). Current photographs of the site are presented in Figure 1.11.

### 3.5.4.2 Proposed Activities

Four soil borings will be advanced at AOC 18 using DPT. The purpose of these borings will be to identify and characterize contamination associated with AOC 18. Figure 3.6 illustrates the proposed soil boring locations. Continuous cores will be used to evaluate the physical characteristics of the soil. Soil samples will be collected at 5-foot intervals from the ground surface to the water table, and submitted for analysis. Soil samples will be analyzed for the following reduced list of Appendix IX analyses.

### Appendix IX

- SW8260B VOCs
   SW8270C SVOCs
- ► SW6010B metals

### • SW7471A - mercury

The proposed analyses for the site are summarized in Tables 3.12 and 3.13.

Additional soil borings may be installed at a later date to delineate the extent of any contamination found to be originating from AOC 18.

Contamination has not been previously detected at this site. Therefore, a groundwater investigation will only be performed if the initial soil investigation indicates a release has occurred. Monitoring wells will be installed using a HSA. Each will be completed 1-foot into the bedrock. The monitoring well pattern will consist of one upgradient well and three downgradient wells. The wells will then be sampled and groundwater analyzed based on results of the soil investigation. Three rounds of bimonthly groundwater sampling will be conducted. Analytical data will be used to assess if contaminants at AOC 18 have impacted the groundwater.

### 3.5.5 AOC 19

### 3.5.5.1 Site Investigation History

To date there have been no investigative activities conducted for AOC 19. Historic aerial photographs of the site indicate a possible former fire training area (see Figure 1.12). Current photographs of the site are presented in Figure 1.13.

Although no investigative activities have been conducted at AOC 19, HydroGeoLogic performed a RFI/CMS at SWMU 25, which overlaps AOC 19 (HydroGeoLogic, 1997). Geophysical surveys conducted at the site identified anomalies in the vicinity of SWMU 25. Eight test pits were excavated during the course of the investigation (THGLA021 through THGLA028), three of which were in the area of AOC 19. Concrete and reinforcement bar were discovered in test pits THGLA026 and THGLA027. Test pit locations are depicted on Figure 3.7 (HydroGeoLogic, 1997).

One surface soil sample and one subsurface soil sample were collected at each test pit location within AOC 19. Soil samples were analyzed for inorganics (EPA Methods 6010A and 7410), VOCs (EPA Method 8260A), and SVOCs (EPA Method 8270B) (HydroGeoLogic, 1997).

THGLTA027 was the only sample location within AOC 19 that had detections of inorganics above background concentrations (HydroGeoLogic, 1997). Surface soil inorganic sample results are presented in Table 3.25.

No VOCs or SVOCs were detected within AOC 19 (test pits THGLTA026, THGLTA027, and THGLTA028) at levels above the PQLs (HydroGeoLogic, 1997). Surface soil organic sample results are presented in Table 3.26.

Several inorganics were detected in the subsurface soil samples collected from the test pits. Chromium and lead concentrations exceeded both the background and MSC values at THGLTA027. THGLTA027 was the only sample location within AOC 19 that had detections of

inorganics above the background and MSCs. All other inorganic concentrations detected above background values were below RRS2 cleanup levels. A summary of subsurface inorganic concentrations is presented as Table 3.27. All VOCs and SVOCs detected in subsurface samples were below PQLs (HydroGeoLogic, 1997).

In November 1999 HydroGeoLogic installed two monitoring wells (WHGLTA801 and WHGLTA803) in and near AOC 19 as part of the SWMU 25 investigation. Although groundwater and soil samples were collected, analytical data is not available at this time. Information from these analytical results, when available, will be incorporated into the investigation strategy for AOC 19.

Although the investigation conducted at SWMU 25 provides some information on contaminant concentrations at AOC 19, additional investigative activities will be necessary in order to accurately characterize this site.

### 3.5.5.2 Proposed Activities

Four soil borings will be advanced at AOC 19 using DPT. The purpose of these borings will be to identify and characterize contamination associated with AOC 19. Figure 3.7 illustrates the proposed soil boring locations. Continuous cores will be used to evaluate the physical characteristics of the soil (or landfill waste, if it is encountered). Soil samples will be collected at 5-foot intervals from the ground surface to the water table, and submitted for analysis. Soil samples will be analyzed for the following reduced list of Appendix IX analyses.

### Appendix IX

- SW8260B VOCs
- SW8270C SVOCs
- SW6010B trace elements (metals)
- SW7471A mercury

The proposed analyses for the site are summarized in Tables 3.12 and 3.13.

Additional soil borings may be installed at a later date to delineate the extent of any contamination found to be originating from AOC 19.

If the initial soil investigation indicates that a release has occurred at AOC 19, monitoring wells may be installed using a HSA. Each will be completed 1-foot into the bedrock. The monitoring well pattern will consist of one upgradient well and three downgradient wells. Groundwater will be collected from the newly installed monitoring wells and from the existing monitoring well WHGLTA801, and will be analyzed for a reduced list of Appendix IX analyses based on the results of the initial soil investigation. Three rounds of bimonthly groundwater sampling will be conducted. Analytical data will be used to assess if contaminants at AOC 19 have impacted the groundwater.

### 3.5.6 Mobilization

Mobilization to the field is expected to begin as soon as relevant portions of the WP are approved. Several basic requirements for conducting field activities have already been established. Contractor photographic identification badges have been obtained for lead personnel who will escort subcontractors to and from restricted areas. The field office and primary staging area for field equipment and supplies will be located at 6560 White Settlement Road, NAS Fort Worth JRB, Texas.

### 3.5.7 Aquifer Testing

Aquifer testing will not be conducted during this field effort. Hydrological properties at the subject sites will be characterized using the aquifer data presented in the CH2M HILL RFI report for AOC 2 (CH2M HILL, 1998).

# TAB

Tables

## Table 3.1 Project Objectives and Data Needs SWMUs 19, 20, 21, and 53; and AOCs 17, 18, and 19 NAS Fort Worth JRB, Texas

Primary Objectives	Data Needs	Work Task <sup>1</sup>
Characterize site specific geology/hydrogeology at each of the SWMUs and AOCs	Depth to groundwater, depth to bedrock, unit represented by bedrock	Install and sample new and existing monitoring wells
Determine the presence and extent of any subsurface anomalies at SWMUs 19,20, and 21 and AOC 17.	Locations and boundaries of subsurface anomalies.	Geophysical investigations
Characterize potential source of contamination	Identify if waste handled at site has impacted the environment	Advance and sample soil borings, install and sample monitoring wells
Determine nature and extent of any detected contamination	Lateral and vertical extent of contamination in soil and groundwater	Advance direct push soil borings with surface and subsurface sampling, monitoring well installation and monitoring sampling

<sup>&</sup>lt;sup>1</sup>Soil borings will be advanced using DPT methods while monitoring wells will be installed using HSA drilling methods.

### Table 3.2 1985 Surface Soil Analytical Results Summary SWMU 19 NAS Fort Worth JRB, Texas

	Para	meter	Soil I	Boring
Compound <sup>1</sup>	BG/PQL (mg/kg)	MSC (mg/kg)	12F (0 ft)	12F (2 ft)
Metals*		_		
Barium	233	233	20	92
Cadmium	0 5562	0.5562	ND	0.54
Chromium	21.056	21.056	7.6	13
Lead	30.97	30.97	16	52
Mercury	0.14	0.2	0.12	0.07
Selenium	0.9072	5	<4	35
Silver	0.213	51	2.8	2.2
VOCs (601, 602)				
1,2-Dichlorobenzene	0.01	60	ND	0.689
1,1,2,2-Tetrachlorethane	0.01	1.4	ND	0.273
Trichloroethene	0.01	0.5	256	0.277
Trichlorofluoromethane	0.01	3100	210 '	ND
Benzene	0.5	0.5	6.44	ND
Ethylbenzene	0.5	70	32.2	ND
Toluene	0.5	100	12.2	ND
Organic Indicators*			ŧ	
Oil and Grease	10	NV	17,000	13,000
Phenois	0.1	6100	< 0.1	1.5

### Notes:

Shaded boxes show results above the BG/PQL.

Shaded boxes with double borders show results above both the BG/PQL and the MSC.

BG = Background Concentrations (Jacobs 1998)

MSC = Medium-specific concentration for industrial use based on groundwater protection

ND = Not Detected NV = No Value

PQL = Practical Quantitative Limit

\*Analytical method not reported

<sup>1</sup> Only compounds with detectable concentrations are reported.

Table 3.3
1985 Subsurface Soil Analytical Results Summary
SWMU 19
NAS Fort Worth JRB, Texas

	Parameter	neter			Mon	Monitoring Wells/Soil Boring	Soil Boring			
Compound <sup>1</sup>	BG/PQL (mg/kg)	MSC (mg/kg)	FT09-12A (19-20 ft)	FT09-12B (9-10 ft)	FT09-12B (14-15ft)	FT09-12B (34-35 ft)	FT09-12C (24-25 ft)	12F (4 ft)	12F (6 ft)	12F (8 ft)
Metals*										
Barnum	128.1	200	28	34	2.4	4.4	7.5	74	59	23
Cadium	0.5891	0.5891	0.28	0.45	QN	ND	QΝ	ND	ND	ND
Chromium	16.31	16.31	4.6	5.0	1.4	0.84	2.5	14	6.3	8.6
Lead	12.66	12.66	6.8	10 6	QN	QN	QN	61	13	ND
Mercury	0.035	0.2	<0.04	<0.04	< 0.04	<0.04	< 0.04	0.10	< 0.05	0.21
Selenium	03130	S	8.6	12.2	<7.3	<8.4	<7	24	17	< 4.0
Silver	0.1277	51	0.63	09:0	0.81	<0.16	< 0.17	1.6	1.8	0.46
VOCs (601, 602)										
1,2-Dichlorobenzene	0.01	09	ND	ND	ND	ND	ND	1.659	1.170	0.721
1,3-Dichlorobenzene	0.01	NV	ND	ND	ND	ND	ND	0.464	0.364	0.273
1,1,2,2- Tetrachloroethane	0.01	1.4	QN	QN	QN	QN	ND	0.327	0.384	1

Table 3.3 (Continued)
1985 Subsurface Soil Analytical Results Summary
SWMUs 19, 20, and 21
NAS Fort Worth JRB, Texas

	Parameter	neter			Mon	Monitoring Wells/Soil Boring	Soil Boring			
Compound!	BG/PQL (mg/kg)	MSC (mg/kg)	FT09-12A (19-20 ft)	FT09-12B (9-10 ft)	FT09-12B (14-15 ft)	FT09-12B (34-35 ft)	FT09-12C (24-25 ft)	12F (4 ft)	12F (6 ft)	12F (8 ft)
Ethylbenzene	0.25	70	ND	ND	2.9	ND	ND	28.4	63.8	011
Toluene	0.25	100	ND	ND	1.4	ND	ND	36.1	64.3	134
Trichloroethene	0.01	0.5	ND	ND	ND	ND	ND	0.299	0.320	0.395
Organic Indicators*										
Oil & Grease	10	NV	ND	QN	700	ND	ND	008'6	8,200	11,000
Phenols	0.1	6100	QN	ND	ND	QN	ND	1.2	2.0	2.4

Notes:

Shaded boxes show results above the BG/PQL.

Shaded boxes with double borders show results above both the BG/PQL and the MSC.

= Background Concentrations (Jacobs, 1998)

MSC= Medium-specific concentrations for industrial use based on groundwater protection

ND = Not Detected

PQL = Practical Quantitative Limit
\*Analytical method not reported

Only compounds with detectable concentrations are reported.

Table 3.4
1985 Groundwater Analytical Results Summary
SWMU 19
NAS Fort Worth JRB, Texas

					Monitoring Wells	g Wells		
	Paramete	neter	Ŧ	February 1985			March 1985	
Commonad	BG/PQL (mg/L)	MSC (mo/L)	FT09-12A	   FT09-12B	FT09-12C	FT09-12A	FT09-12R	FT09-12C
Metals*	(2,8							
Barium	0.587	2	0.079	0.14	0.18	0.11	0.16	0.18
Mercury	0.0001	0.002	< 0.0002	0.0003	< 0.0002	< 0.0002	< 0.0002	<0.0002
VOCs (601/602)								
Trichlorofluoromethane	PQL	31	14.2	ND	12.0	4.0	ND	ND
1,1-Dichloroethene	PQL	0.007	QN	ND	ND	QN	ND	2.5
1,1-Dichloroethane	PQL	10	QN	QN	ND	QN	QN	5.85
1,1,1-Trichoroethane	PQL	0.005	QN	ND	2.9	2.6	ND	2.9
Trichloroethene	PQL	0.005	QN	360	4.8	2.2	190	5.7
Tetrachlorothene	PQL	0.005	QN	181.5	4.65	2.55	89.6	8.4
1,4-Dichlorobenzene	PQL	NV	QN	ND	ND	QN	ND	3.6
Organic Indicators*								
Oil and Grease	1	NV	37.5	34	68	ND	ND	QN
Phenols	0.005	61	210.0	0.017	0.005	ND	ND	900'0
Total Organic Carbon	1	NV	ND	Į	5	ND	ND	ND
Total Organic Halides	0.1	NV	ND	0.38	0.03	0.01	0.38	0.11

Notes:

Shaded boxes show results above the BG/PQL.

Shaded boxes with double borders show results above both the BG/PQL and the MSC.

= Background Concentrations (Jacobs, 1998)

MSC = Medium-specific concentrations for industrial use based on groundwater protection

ND = Not Detected

PQL = Practical Quantitative Limit

\*Analytical method not reported <sup>1</sup> Only compounds with detectable concentrations are reported.

## Table 3.5 1985 Surface Water Analytical Results Summary SWMU 19 NAS Fort Worth JRB, Texas

	Parai	neter	Sampl	e Dates
Compound <sup>1</sup>	BG/PQL (mg/L)	MSC (mg/L).	January 1985	February 1985
Metals*			4	
Arsenic	0.0049	0.05	0.16	<0.06
Barium	0.151	2.0	0.29	0.15
Cadmium	0.0005	0.005	0.007	< 0.002
Chromium	0.0078	0.1	0.017	< 0.005
Lead	0.0016	0.015	0.081	<0.08
Mercury	0.0001	0.002	0.0003	0.0006
Selenium	0.0115	0.05	< 0.08	< 0.08
Silver	0.0003	0.5	<0.002	< 0.002
Organic Indicators*				
Oil & Grease	PQL	NV	84,000	1
Phenois	PQL	61	0.14	ND
Total Organic Carbon	PQL	NV	50,000	86
Total Organic Halides	PQL	NV	0.63	<0.01
VOCs (601, 602)				
Trichlorofluoromethane	PQL	31	ND _	3.5

### Notes:

Shaded boxes show results above the BG/PQL.

Shaded boxes with double borders show results above the BG/PQL and the MSC.

BG = Background Concentrations (Jacobs 1998)

MSC = medium-specific concentrations for industrial use

ND = Not Detected

NR = Not Reported

NV = No Value

PQL = Practical Quantitative Limit

<sup>1</sup> Only compounds with detectable concentrations are reported.

<sup>\*</sup>Analytical method not reported

Table 3.6
1988 Soil Analytical Results Summary
SWMU 19
NAS Fort Worth JRB, Texas

	Parameter	eter				Monitorin	Monitoring Well/Soil Boring	Soring			
Compound	BG/PQL (mg/kg)	MSC (mg/kg)	FT09- 12D (15-20 ft)	FT09- 12D (25-30 ft)	FT09- 12E (4-6 ft)	FT09-12E (14-19 ft)	FT09- 12E (24-29 ft)	12G (14-17 ft)	12H (0-4 ft)	12H (4-9 ft)	12H (9-14 ft)
Metals (6010)											
Aluminum	17180	17180	820.0 E	740 0 E	0 0098	510.0	2000.0	7100.0	13000 0	10000.0	5400.0
Antimony	0.712	0.712	<5.9	<5.9	7.0	<5.8	<5.9	19.0	<5.9	16.0	40.0
Arsenic	5.533	5.533	<29.0	<30.0	< 29 0	<29.0	<29.0	<30.0	30.0	<30.0	<29.0
Barium	128.1	200	4.9 E	5.8 E	43.0	2.6	8.6	33.0	86.0	170.0	37.0
Beryllium	0 957	0.957	0 1	0.1	0.5	0.1	0.2	0.3	4.0	0.5	0.3
Садтит	0.5891	0.5891	ND	0 3	ND	0.5	ND	7.0	9.0	ND	QN
Calcium	272000	272000	650.0	44000.0	51000.0	340.0	5600.0	120000.0	41000.0	120000.0	160000.0
Chromium	16.31	16.31	2.2	3.0	9.6	2.4	6.4	8.7	14.0	12.0	9.5
Cobalt	6.191	610	Q.	Ø	3.8	1.9	2.3	1.6	4.6	4.4	3.2
Copper	13.72	130	1 9	1.3	3.0	QN.	2.0	1.6	3.4	1.5	2.9
Iron	15224	15224	2700.0	2600.0	8800.0	3200.0	7800.0	7700.0	12000.0	9000.0	8400.0
Lead	12.66	12.66	ND	QV QV	13.0	09	11 0	9.0	16.0	11.0	11.0
Magnesium	2420	2420	120 0 E	350.0 E	1700.0	74.0	420.0	1400.0	1700.0	1800.0	1400.0
Manganese	351.7	1400	21.0 E	41.0 E	76.0	21.0	60.0	47.0	250.0	190.0	180.0
Nickel	19.76	200	2.0	ON	9.0	4.0	6.0	6.0	10.0	0.6	8.0
Potassium	1717	1717	80.0	80.0	1200.0	45.0	270.0	0.069	1100 0	1000.0	640.0
Selenium	0 313	5.0	< 29.0	<30.0	< 29.0	<29.0	<29.0	<30.0	50	30	<29.0
Silicon	NV	NV	350.0 E	440.0	310 0	280 0	330.0	320.0	350.0	280 0	290.0

Table 3.6 (continued)
1988 Soil Analytical Results Summary
SWMU 19
NAS Fort Worth JRB, Texas

	Parameter	eter				Monitorin	Monitoring Well/Soil Boring	oring			
Compound	BG/PQL (mg/kg)	MSC (mg/kg)	FT09- 12D (15-20 ft)	FT09- 12D (25-30 ft)	FT09- 12E (4-6 ft)	FT09-12E (14-19 ft)	FT09- 12E (24-29 ft)	12G (14-17 ft)	12H (0-4 ft)	12H (4-9 ft)	12H (9-14 ft)
Silver	0.1277	51	1.1	<0.89	<0.89	1.5	1.4	1.3	<0.88	2.3	2.0
Sodium	53200	53200	70.0 E	140.0 E	40 0	39.0	43.0	93.0	74.0	91.0	87.0
Thallium	65.4	65.4	ND	ND	9.0	ND	GN CN	12.0	Ð	QN	10.0
Vanadrum	37.39	72	4.0	7.0	22.0 E	6.0 E	15.0 E	27.0 E	30.0 E	28.0 E	29.0 E
Zinc	31.27	3100	3.3 E	3 2 E	17.0	3.7	9.8	12.0	18.0	15.0	12.0
TPH (418.1)		-1									-
ТРН	90	5002	ND	ND	ΩN	14.0	QN	QN	3230.0	2110.0	450.0
VOCs (8240)											
2-Butanone	0.1	WV	ND	ΩN	ON	QN	QN	QN	3.6 BJ	5.1 B	8.0 B
Benzene	0.1	0.5	ND	ND	ND	ND	ND	ND	0.37 J	QN	<1.1
Ethylbenzene	0.1	0/	QN	QN	QN	ND	ND	ND	4.1	4.8	1.1 J
Toluene	0.1	100	QN	0.029	0.018	0.0019 J	0.0042 J	0.019	11.0	1 00 .	1.9
Acetone	0.1	1000	0.011 B	0.014 B	0.012 B	0.015B	0.029 B	0.015B	0.74 BJ	4.0 B	2.5 B
Total Xylenes	0.1	1000	QN	ND	QN	ND	ND	ND	32.0	31.0	6.4
SVOCs (8270)											
2-Methylnaphthalene	1	410	ND	QN	ND	ND	ND	ND	8.7	4.8	0.66 J
4-Methylphenol	1	NV	ND	ND	ND	ND	ON	MD	4.2	0.76 J	QN
Bis(2-ethylhexyl) phthalate	1	900.0	ON	ND	QN	ND	QN .	0.19 J	0.53	0.33	1.1 B

Table 3.6 (continued)
1988 Soil Analytical Results Summary
SWMU 19
NAS Fort Worth JRB, Texas

	Parameter	eter				Monitorin	Monitoring Well/Soil Boring	toring			
Compound	BG/PQL (mg/kg)	MSC (mg/kg)	FT09- 12D (15-20 ft)	FT09- 12D (25-30 ft)	FT09- 12E (4-6 ft)	FT09-12E (14-19 ft)	FT09- 12E (24-29 ft)	12G (14-17 ft)	12H (0-4 ft)	12H (4-9 ft)	12H (9-14 ft)
Di-n-butylphthalate	I	1000	S S	S.	QN.	Ð	Ð	0.31 B	0.62 B	0.61 B	QN
Di-n-octyl phthalate	1	200	QN.	ND ON	QN	QN	QN	0.18 J	0 15 J	0.22 J	0.14 BJ
Dibenzofuran	1	NV	UN	ND	αN	QN	QN	QN	0.17 J	ND	QN ·
Naphthalene	1	200	ND	ND	αN	QN	QN	ND	3.9	2.7	0 31
Phenol	1	6100	ON	QN QN	ON	QN	QN	QN	0.50	0.36	ON

See Notes at end of Table 3 6

Table 3.6 (continued)
1988 Soil Analytical Results Summary
SWMU 19
NAS Fort Worth JRB, Texas

	Parameter	leter					Soil Boring				
Compound	BG/PQL (mg/kg)	MSC (mg/kg)	12H (14-19 ft)	12H (19-25 ft)	12I (4-9 ft)	121 (9-14 ft)	12I (19-24 ft)	12J (4-9 ft)	12J (9-14 ft)	12J (19-23 ft)	12K (20-25 ft)
Metals (7000)		:						9			
Aluminum	17180	17180	5900.0	380.0	13000.0	9500.0	590.0	21000.0	10000.0	0.006	5300 0
Antimony	0.712	0.712	0.6	<5.9	28.0	22.0	<5.8	31	30.0	10.0	6.0
Arsenic	5.533	5.533	< 29.0	<29.0	<29.0	<29.0	<29.0	<30.0	<28.0	<27.0	< 30.0
Barium	128.1	200	37.0	3.4	54.0 E	42.0 E	15.0 E	91.0 E	38.0 E	7.0 E	49.0
Beryllium	0.957	0 957	0.5	QN	0.5	0.4	0.1	0.8	0.5	0.090	0.4
Cadmium	0.5891	0.5891	QN.	0.8	0.7	ND	0.5	90	0.5	0.3	QN
Calcium	272000	272000	61000.0	520.0	130000.0 E	110000.0 E	5600.0 E	120000.0 E	110000 0 E	980.0 E	27000 0
Chromium	16.31	16.31	9.1	3.6	13.0	11.0	4.2	19.0	13.0	4.0	9.9
Cobalt	6.191	610	4.5	1.6	2.6	2.8	1.2	4.8	5.2	1.7	4.6
Copper	13.72	130	5.2	QN	2.1	3.6	1.3	5.0	4.8	2.0	5.1
Iron	15224	15224	0.0066	3,900.0	10000.0	0'0088	5500.0	13000.0	10000.0	3400.0	11000.0
Lead	12.66	12.66	14.0	6.0	14.0	7.0	7.0	20.0	12.0	12.0	11.0
Magnesium	2420	2420	1200.0	0 99	2200.0 E	1800.0 E	110 0 E	2700.0 E	2000.0 E	150.0 E	930.0
Manganese	351.7	1400	280.0	40	170	200	170	240	150.0	100.0	230.0
Nickel	19.76	200	9.0	GN	0'6	7.0	3.0	12.0	8.0	4.0	0.6
Potassium	1717	1717	730.0	90.0	1200.0	1100.0	ON	1900.0	1300.0	130.0	0 0/9
Selenium	0.313	5.0	. <29.0	<29.0	42	<29.0	<29.0	70	30.0	<27.0	<30.0
Silicon	NV	N	290.0	250.0	330.0	320.0	260.0	290.0	230.0	270.0	330.0
Silver	0.1277	51	2.7	3.9	<0.88	<0.87	<0.87	2.0	1.4	1.7	1.9

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# Table 3.6 (continued) 1988 Soil Analytical Results Summary SWMU 19 NAS Fort Worth JRB, Texas

	Parameter	neter					Soil Boring				
Compound	BG/PQL (mg/kg)	MSC (mg/kg)	12H (14-19 ft)	12H (19-25 ft)	12I (4-9 ft)	12I (9-14 ft)	12I (19-24 ft)	12J (4-9 ft)	12J (9-14 ft)	12J (19-23 ft)	12K (20-25 ft)
Sodium	53200	53200	71.0	44.0	22.0	ON	ND	ND	0.29	UD	68.0
Thallium	65.4	65.4	0 91	QN	ND	11.0	9.0	ND	QN	ND	10 0
Vanadıum	37.39	$\overline{z}$	24.0 E	8.0 E	32.0	22.0	11.0	42.0	26.0	9.0	25.0 E
Zinc	31.27	3100	16.0	2.6	180E	15.0 E	3.4 E	24.0 E	17.0 E	4.7 E	17.0
TPH (418.1)											
ТРН	90	5002	340.0	5760.0	670.0	450.0	1250.0	ND	QN	17	14
VOCs (8240)											
1,1,2,2- Tetrachloroethane	0.1	1.4	<0.56	1.3 J	<10	<0.99	QN	ND	ND	ND	ND
2-Butanone	0.1	ΛN	5.7 B	< 16.0	5 0 B	6.0 B	ND	ND	ND	QN	0.034
4-Methyl-2- pentanone	0.1	NV	< 6.8	<29.0	<6.7	>6.6	QN	0.023 J	ND	QN.	Ð
Benzene	0.1	0.5	Ę	<2.8	<0.64	0.54 J	QN	ON	QN	ND	ND
Ethylbenzene	0.1	92	0.89 J	5.0	1.3	5.6	QN	ND	ND	ND ON	Q.
Toluene	0.1	100	0.24 J	3.7 J	1.7	2.2	0.016	0.013	QN ON	0.0064	0.0011 J
Acetone	0.1	1000	11.0 B	0 87 BJ	8.2 B	5.4 B	0.057 B	0 035 B	0.016B	0.014B	0 013 B
Methylene Chloride	0.1	50	<0.41	<1.8	<0.41	<0.40	0.0050	0.12	0.0039	0.0062	Q.

### 1988 Soil Analytical Results Summary NAS Fort Worth JRB, Texas Table 3.6 (continued) **SWMU 19**

	Parameter	neter					Soil Boring				
Compound	BG/PQL (mg/kg)	MSC (mg/kg)	12H (14-19 ft)	12H (19-25 ft)	12I (4-9 ft)	12I (9-14 ft)	12I (19-24 ft)	12J (4-9 ft)	12J (9-14 ft)	12J (19-23 ft)	12K (20-25 ft)
SVOCs (8270)											
2-Methy Inaphthalene	1	410	0.95	11.0	2.0	2.0	0 84	ND	ND	ND	ND
4-Methylphenol	1	ΛN	QN	<7.6	1.4	0.26 J	0.16 J	ND	ON	ND	ND
Bis(2-ethylhexyl) phthalate	1	9.0	1.4 B	12.0 B	1.4 B	0.58 B	0.86 B	ND	QN	0.32 B	0.12 J
Di-n-octyl phthalate	1	200	ON	<1.9	0.21	0.47	0.095 J	ND	QN	ND	QN
Naphthalene	1	200	0.37	4.7	0.95	0.94	0.28	ND	QV	N ON	CIN

Shaded boxes show results above the BG/PQL. Shaded boxes with double borders show results above both the BG/PQL and the MSC

= Analyte detected in reagent blank

= Background Concentrations (Jacobs 1998)

= Value is estimated due to the presence of an interferant = Estimated value

= Medium-specific concentration for industrial use based on groundwater protection = Not Detected MSC

= No Value

= Practical Quantitative Limit

= Only compounds with detectable concentrations are reported = Action level for course-grained soils from TNRCC RG-17

Duplicate analysis is not within control limits Source: Radian, 1989

Table 3.7
1988 Groundwater Analytical Results Summary
SWMU 19
NAS Fort Worth JRB, Texas

							Monitor	Monitoring Wells				
	Parameter	neter		Febru	February/March 1988	h 1988			·	April 1988	<b>8</b> 2	
Compound	BG/PQL (mg/L)	MSC (mg/L)	FT09- 12A	FT09- 12B	FT09- 12C	FT09- 12D	FT09- 12E	FT09. 12A	FT09. 12B	FT09- 12C	FT09- 12D	FT09- 12E
Metals (200.7)												
Aluminum	11.07	100	16.0	130 O B	100 0	0.061	120.0	63.0	21.0	97.0	76.0	27 0
Antimony	0.0024	900 0	< 0.060	0:30	0.39	0.50	0.59	0.15	<0.060	0.39	0.16	< 0.060
Arsenic	2900 0	0 05	<0.30	<0.30	<0.30	<0.30	<0.30	1.0	< 0.30	< 0.30	<0.30	<0.30
Валит	1 133	2.0	0 14	0 53	0 66	0.79	0.34	0.29	0.17	0.76	0.46	0 34
Beryllum	0.0019	0 004	01000	0.0030	0:0030	09000	0.0020	0 00 0	QN	0:0030	0:0030	ND
Calcium	2438	2438	220 0	1200.0 B	2000 0	23000.0	2900.0	0.029	310.0	2600.0	1300.0	9.098
Садплит	0 0016	0 005	0:0030	0800.0	< 0.003	0.015	0.0070	0.0040	0.0040	0.011	0 0040	< 0.003
Chromium	0.0136	0.1	0 033	0.22	0.22	0.35	0.31	0.10	0.035	0.23	0 17	0.089
Cobalt	0.01	6.1	ND	0.070	0.050	0.12	0.060	QN	100	080 0	090.0	0 0 0 0 0 0 0
Copper	0 0101	1.3	ND	0.080	0.050	0.24	0.13	0 0 0 0	QN	0.080	0.11	0.040
Iron	7 234	7.234	15.0	150.0B	120.0	330 0	200.0	58.0	25.0	140 0	160.0	56.0
Lead	0 0016	0.015	0.041	0.13	0.090	0.27	0.13	0.060	< 0.050	0 19	0.11	0 08
Magnesium	88.78	68 78	6.4	29 0	34.0	45 0	40 0	17.0	8.4	39.0	25.0	13 0
Manganese	10.57	14	0 17	3.5	7.2	4 0	5.7	65 0	0.79	7.9	1.9	1.8
Nickel	0.0364	2.0	ND	0.20	0.18	0.31	0.23	0.060	0:030	0.18	0 15	0.060
Potassium	3.9	3.9	3.2	19 0 R	18.0	28.0	20.0	13.0	2.7	16.0	10 0	3.8
Selenum	0.0072	0.05	< 0.30	0.50	< 0.30	09:0	0.50	< 0.30	< 0.30	0.5	09:0	< 0.30

Table 3.7 (continued)
1988 Groundwater Analytical Results Summary
SWMU 19
NAS Fort Worth JRB, Texas

							Monitoring Wells	ng Wells				=
•	Parameter	neter		Febru	February/March 1988	h 1988				April 1988	oc l	
Compound	BG/PQL (mg/L)	MSC (mg/L)	FT09- 12A	FT09- 12B	FT09- 12C	FT09- 12D	FT09- 12E	FT09- 12A	FT09- 12B	FT09- 12C	FT09- 12D	FT09- 12E
Silver	0 0003	0.51	0600'0>	<0.000 0	< 0.0090	0.010	< 0.0090	06000>	0600 0 >	0.010	< 0.0090	<0.0090
Silicon	Ā	AN	42.0	160.0 B	130.0	140 0	120.0	78.0℃	48 0	110 0	92 0	50.0
Sodium	176.2	176.2	13.0	23 0	25 0	32.0	23 0	14.0	22 0	28 0	34.0	23.0
Thallium	0.0632	0.0632	<i>LL</i> 0'0	<0.090	< 0.090	< 0.090	0.11	< 0.090	0.13	<0.090	0.11	0 12
Vanadıum	0.0653	0.72	0.053	0 39	0.36	0.93	0.53	0.17	0 000	0.40	0.46	0.15
Zunc	0 0682	31	0 018	0.31	0.19	0.55	0.33	0.11	0 034	0.22	0.27	0.12
Water Quality Parameters <sup>2</sup>	ıters²										,	
Arsenic, graphite AA	0.0067	0.05	0.010	0.051	0.056	0.082 B	0.028	0.039	0.019	0.074	0.054	0 033
Chloride	1	NV	15.0-	0.9	_ 180	9.0	150	4.4	. 28.0	_ 26.0 _	23.0	16.0.
Fluoride	0.1	NV	0.34	0 25	0 26	0.31	0.22	0.33	0.29	0.34	0.33	0.27
Lead, graphite AA	0.0016	0.015	0900'0	0.048	0.050	0 13 B+	0.061	NA	0.05	NA	NA	ΝΑ
Mercury	0.0001	0.002	ND	ND	0 00030	0.00030	0.00010	ND	ΩN	0.0002	ND	QN QN
Nitrate + Nitrite	0 02	10	0 52	0.26	<0.10	0.46	0.13	0.46	0.43	< 0.20	0.72	12
Orthophosphate	0.02	NV	0.040	080.0	0.00	0.050	ND	0.15	0.040	ND	0.030	ΩN
Selenum, graphite AA	0 0072	0.05	0 0040	QN	< 0.020	QN .	ND	QN	QN	QN ON	ON	QN
Sulfate	1	NV	29 0	28 0	15.0	61.0	31.0	30.0	52.0	18.0	120.0	88.0
Total Dissolved	10	NV	380.0	510.0	540 0	590.0	530.0	430 0	490 0	550.0	570.0	290 0

Table 3.7 (continued)
1988 Groundwater Analytical Results Summary
SWMU 19
NAS Fort Worth JRB, Texas

							Monitor	Monitoring Wells				
	Parameter	neter		Febru	February/March 1988	h 1988				April 1988	88	
Compound <sup>1</sup>	BG/PQL (mg/L)	MSC (mg/L)	FT09- 12A	FT09- 12B	FT09. 12C	FT09- 12D	FT09- 12E	FT09. 12A	FT09- 12B	FT09- 12C	FT09- 12D	FT09- 12E
TPH (418.1)												,
ТРН	1	53	ND	ΩN	90	ND	QN	ND	ND	UD	QN	QN
Purgeable Halocarbons (601)	(601)											
1, i-Dichloroethane	0.005	10	ND	QN	0.0032	ND	08000 0	ND	QN	QN	ND	0.00040
1,4-Dichlorobenzene	0 002	0.075	ΩN	<0.010	ND	< 0.0100	0 0026	QN	<0.0100	QN	< 0 0100	0.0016
1,1,1-Trichloroethane	0.005	0.2	ΩN	QN	0.00030	ND	ND	QN	UD	QN	ΩN	0.00040
Chloroethane	0.005	41	QN	<0.013 0	ND	< 0.0130	QN	QN	< 0.0130	ΩN	< 0.0130	090000
СһІогоботп	0 005	0 1	QN	ΩN	ND	QΝ	αN	0.00020	QN	ND	ND	Ð
Tetrachloroethene	0.005	0.005	QN	0.0430	0.0025	QN	QN	0.00003	0 0490	0 0027	QN	0.0003
Trichloroethene	0.005	0 005	ΩN	0.1100	0 0030	0.0480	0.00080	0 00020	0.1000	ND	0.055	0.0011
Vinyl chloride	0 005	0.002	ND	ND	0.0180	QN	0 0034	ND	ΩN	0.015	GΝ	0.0018
Purgeable Aromatics (8020)	(070)				:							
1,2-Dichlorobenzene	0 0004	90	QN	0 001	M	ΩN	ΩN	ΩN	<0 0020	0 0023	< 0.0130	<0.0050
1,4-Dichlorobenzene	0.0004	0 075	ON	<0.008	ND	QN	0.0052	ND	<0.0020	0.0014	QN.	0.0016
Benzene	0 0004	0 000	QN	<0.005	ND	QN	ND	QN	<0 0010	Q.	QN	0.00030
Toluene	0.0004	1	0.0011	0.009	0.0170	0.0076	0 0470	0 0012	< 0.0010	0.0010	0.0018	0.0010

1988 Groundwater Analytical Results Summary NAS Fort Worth JRB, Texas Table 3.7 (continued) **SWMU 19** 

							Monitori	Monitoring Wells				
	Parameter	neter		Febru	February/March 1988	հ 1988	¥			April 1988	œ	
Compound	BG/PQL (mg/L)	(MSC) (mg/L)	FT09- 12A	FT09- 12B	FT09- 12C	FT09- 12D	FT09- 12E	FT09- 12A		FT09- FT09- 12B 12C	FT09- 12D	FT09- 12E
Extractable Priority Pollutants (625)	ollutants (625)											
Bıs (2-ethylhexyl) phthalate	0.050	900'0	0.0170	NA	NA	NA	NA	NA	NA	0.0023 J	NA	NA
Butylbenzylphthalate	0.050	20	ND	NA	NA	NA	NA	NA	NA	0.0089	NA	NA
Di-n-butylphthalate	0.050	10	0.0042 B	NA	NA	NA	NA	NA	NA	0 0014 J	NA	NA

Shaded boxes show results above the BG/PQL.

Shaded boxes with double borders show results above both the BG/PQL and the MSC.

= Analyte detected in reagent blank

= Estimation based upon QC data

= Medium-specific concentration for industrial use = Not Analyzed MSC

= Not Detected

= Practical Quantitative Limit

= Duplicate analysis is not within control limits Percent difference outside control limits

= Only compounds with detectable concentrations are reported.

= Analytical methods 160.0, 325.3, 240.2, 353.1, 365.1, and 375 4

= Action level from TNRCC RG-17

Source. Radian, 1989

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Table 3.8
1993 Soil Analytical Results Summary
SWMUs 19 and 20
NAS Fort Worth JRB, Texas

	Para	Parameter				Sample Numbers	Vumbers			
Compound1	PQL (mg/kg)	MSC (mg/kg)	AST-1 (0.5 ft)	AST-2 (0.5 ft)	AST-3 (0.5 ft)	DFT-1 (0.5 ft)	DFT-2 (1.5 ft)	DFT-3 (2.5 ft)	DFT-4 (0.5 ft)	DFT-5 (1.5 ft)
VOCs (8020)										
Benzene	0.002	0.5	QN	QN	QN	< 0.050	0.011	0.011	ND	1.3
Ethylbenzene	0.002	70	QN	ND	QN	0.3	0.026	0.019	QN	2.6
Toluene	0.002	100	QN	ND	QN	0.057	0.012	0.011	ND	4.3
Xylenes	0.002	1000	QN	ND	QN	1.6	0.220	0.140	0.0049	13.0
втех	0.002	NV	ND	ND	QN	1.9	0.269	0.181	0.0049	21.2
TPH (418.1)			:							
ТРН	10	5005	3500	6100	2800	5300	45	180	4000	13000
										1

See Notes at the end of Table 3.8

Table 3.8 (Continued)
1993 Soil Analytical Results Summary
SWMUs 19 and 20
NAS Fort Worth JRB, Texas

	Parameter	neter			Samp	le Numbers	Sample Numbers sample Numbers	mbers		
Compound	PQL (mg/kg)	MSC (mg/kg)	DFT-6 (2.5 ft)	DFT-7 (0.5 ft)	DFT-8 (1.5 ft)	DFT-9 (2.5 ft)	DFT-10 (0.5 ft)	DFT-13 (0.5 ft)	DFT-19 (0.5 ft)	DFT-20 (1.5 ft)
VOCs (8020)										
Вепzепе	0.002	0.5	1.5	<0.2	< 0.050	QN	ND	ND	Q	QN
Ethylbenzene	0.002	70	3.3	ND	1.1	0.1	ND	ND	QN	0.042
Toluene	0.002	100	4.7	ND	0.710	0.088	ND	ND	QN	0.012
Xylenes	0.002	1000	16.0	0.0045	7.1	0.840	ND	ND	0.062	0.280
BTEX	0.002	NV	25.5	0.0045	8.91	1.03	ND	ND	0.062	0.334
TPH (418.1)										
ТРН	10	5001	8300	1500	2100	150	290	99	1600	ND

1993 Soil Analytical Results Summary NAS Fort Worth JRB, Texas Table 3.8 (Continued) SWMUs 19 and 20

	Para	Parameter			Sample Nt	Sample Numbers sample Numbers	e Numbers		
Compoundt	PQL (mg/kg)	MSC (mg/kg)	DFT- 21 (2.5 ft)	DFT- 22 (0.5 ft)	DFT-23 (1.5 ft)	DFT-24 (2.5 ft)	DFT-25 (0.5 ft)	DFT-26 (1.5 ft)	DFT-27 (2.5 ft)
VOCs (8020)									
Benzene	0.002	0.5	ND	ND	ΩN	ND	ND	< 0.2	<0.50
Ethylbenzene	0.002	70	9/0.0	0.0024	0.012	ND	ΩN	2.6	3.0
Toluene	0.002	100	0.041	0.019	0.0079	0.014	ND	2.0	2.1
Xylenes	0.002	1000	0.470	0.120	0.050	0.038	ND	12.0	12.0
BTEX	0.00	NV	0.587	0.141	0.0699	0.052	ND	16.6	17.1
TPH (418.1)									
ТРН	10	5001	23	80	95	51	450	2300	3100

Notes:

Shaded boxes show results above the PQL.

Shaded boxes with double borders show results above both the PQL and MSC.

MSC = Medium-specific concentration for industrial use based on groundwater protection = Not Detected g

= No Value

Practical Quantitative Limit Ø

Only compounds with detectable concentrations are reported.Action level for course grained soils from TNRCC RG-17

Source: Dames & Moore, 1995

### Table 3.9 1993 Verification Soil Analytical Results Summary SWMUs 19 and 20 NAS Fort Worth JRB, Texas

	Para	meter		Sample	Numbers	
Compound <sup>1</sup>	PQL (mg/kg)	MSC (mg/kg)	VFT-29	VFT-31	VAST-4	VAST-5
VOCs (8020)				ı		
Benzene	0.002	0.5	0.240	1.2	< 0.050	ND
Ethylbenzene	0.002	70	3.2	8.1	0.260	ND
Toluene	0.002	100	4.9	16.0	0.073	ND
Xylenes	0.002	1000	17.0	49.0	1.5	ND
BTEX	0.002	NV	25.3	74.3	1.83	ND
TPH (418.1)				ŀ		
ТРН	10	500²	1100	6400	3900	38

### Notes:

Shaded boxes indicated results above the PQL.

Shaded boxes with double borders indicated results above the PQL and MSC.

BTEX = Benzene, Toluene, Ethylbenzene, and Total Xylenes

MSC = Medium-specific concentrations for industrial use based on groundwater protection

ND = Not Detected NV = No Value

PQL = Practical Quantitative Limit TPH = Total Petroleum Hydrocarbons

= Only compounds with detectable concentrations are reported.

= Action level for course-grained soils from the TNRCC RG-17.

Source: Dames & Moore, 1995

### Table 3.10 1999 Groundwater Analytical Results Summary SWMUs 19, 20, and 21 NAS Fort Worth JRB, Texas

			N	Ionitoring We	lls
	Param	ieter	FT09	-12C	USGS07T
Compound <sup>1</sup>	PQL (mg/L)	MSC (mg/L)	January 1999	April 1999	January 1999
VOCs (8260B)					
1,2-Dichlorobenzene	PQL	0.6	ND	0.002	ND
1,4-Dichlorobenzene	PQL	0.075	ND	0.001	ND
1,1-Dichloroethane	PQL	10	0.0007	0.0006	ND
1,1 Dichloroethene	PQL	0.007	ND	ND	0.0006
Benzene	PQL	0.005	0.001	0.0008	ND
Chlorobenzene	PQL	0.1	ND	0.0004	ND
cis-1,2-Dichloroethene	PQL	0.07	0.033	0.026	0.0008
tert-Butylbenzene	PQL	NV	ND	0.0009	ND
Tetrachloroethene	PQL	0.005	ND	ND	0.001
Trichloroethene	PQL	0.005	0.001	0.001 J	0.0007
Vinyl chloride	PQL	0.002	0.004	0.003	ND

### Notes:

Shaded boxes show results above the PQL.

Shaded boxes with double borders show results above both the PQL and the MSC.

J = Estimated Value

MSC = Medium-specific concentrations for industrial use

ND = Not Detected

NV = No Value

PQL = Practical Quantitative Limit

= Only compounds with detectable concentrations are reported.

Source: HydroGeoLogic, 1999a and 1999b

Table 3.11
Field Activities Summary
NAS Fort Worth JRB, Texas

Site	DPT Borings (to top of water)	HSA Borings (to bedrock)	Borings (total)	Wells
SWMUs 19,20,21	16	2	18	2
SWMU 53	19	1	19	1
AOC 17	7	0	7	0
AOC 18	4	0	4	0
AOC 19	4	0	4	0
Total	50	3	52	3

Notes:

DPT = direct push technology

HSA = hollow stem auger

Table 3.12 Soil Sample Analysis Summary NAS Fort Worth JRB, Texas

j.	Method	Matrix	No. of	No. of Equipment Blanks 2	No. of Ambient Blanks 3	No. of Trip Blanks	No. of Field Duplicates 5	No. of MS/MSD <sup>6</sup>	Total No. of Samples
SWMUs	SW8260B	Soil	72	5	1	5	7	4/4	88
19,20,21	SW8270C	Soil	72	5	0	0	7	4/4	92
	SW6010B	Soil	72	5	0	0	7	4/4	92
	SW7471A	Soil	72	5	0	0	7	4/4	92
SWMU 53	SW8260B	Soil	9/	5	1	5	L	4/4	102
	SW8270C	Soil	9/	5	0	0	L	4/4	96
	SW6010B	Soil	9/	5	0	0	L	4/4	96
	SW7471A	Soil	9/	5	0	0	L	4/4	96
A0C 17	SW8260B	Soil	28	2	1	2	ε	1/1	38
	SW8270C	Soil	28	2	0	0	3	1/1	35
	SW8080A	Soil	28	2	0	0	3	1/1	35
	SW8141A	Soil	28	2	0	0	3	1/1	35
	SW8151A	Soil	28	2	0	0	3	1/1	35
	SW8280A	Soil	28	2	0	0	3	1/1	35
	SW9012A	Soil	28	2	0	0	3	1/1	35
	SW9030A	lioS	28	2	0	0	3	1/1	35
	SW6010B	Soil	28	2	0	0	3	1/1	35
	SW7471A	Soil	28	2	0	0	3	1/1	35
AOC 18	SW8260B	Soil	16	2	1	2	2	1/1	24
	SW8270C	Soil	16	2	0	0	2	1/1	22
	SW6010B	Soil	16	2	0	0	2	1/1	22

### Soil Sample Analysis Summary NAS Fort Worth JRB, Texas Table 3.12 (continued)

				No. of	No. of	No. of			Total
			No. of	Equipment	Ambient	Trip	No. of Field	No. of	No. of
Site	Method	Matrix	Samples 1	Blanks 2	Blanks <sup>3</sup>	Blanks 4	Duplicates 5	MS/MSD ¢	Samples
AOC 18 (cont' d)	SW7471A	Soil	16	2	0	0	2	1/1	22
AOC 19	SW8260B	Soil	16	1	1	1	1	1/1	22
	SW8270C	Soil	16	1	0	0	1	1/1	20
	80109MS	Soil	16	1	0	0	1	1/1	20
	SW7471A	Soil	16	1	0	0	1	1/1	20

samples The actual number of soil samples collected will vary depending on the actual depth to groundwater

Sites where only one boring will be sampled will be paired with a QC sample from another boring. One equipment blank will be taken per analysis (i.e., 3 equipment blanks represents 1 sample/day for 3 days)

Ambient blanks for VOCs will only be sampled if VOCs are detected by the PID during a sampling effort. One ambient blank will be collected at the beginning of the field investigation for soil

Field duplicates will be collected on a 10% basis of investigation samples

MS/MSDs will be collected on a 5% basis of investigation samples

One trip blank will be included per cooler when at least one sample is analyzed for VOCs from that cooler The number of soil samples is based on the estimated average depth to groundwater. Three borings with 4 samples each will yield 12 Soil samples must be collected every 5 feet from the surface to the groundwater

Table 3.13
Groundwater Sample Analysis Summary
NAS Fort Worth JRB, Texas

				No. of	No. of	No. of	No. of		Total
Site	Method	Matrix	No. of Samples <sup>1</sup>	Equipment Blanks³	Ambient Blanks <sup>4</sup>	Trip Blanks <sup>5</sup>	Field Duplicates <sup>6</sup>	No. of MS/MSD'	No. of Samples <sup>2</sup>
SWMU	SW8260B	Groundwater	5	1	1	1	1	0	6
19, 20, 21	SW8270C	Groundwater	5	1	0	0	1	0	7
	SW6010B	Groundwater	S	1	0	0	1	0	7
	SW7470A	Groundwater	S	1	0	0	1	0	7
SWMU 53	SW8260B	Groundwater	9	1	1	1	1	0	10
_	SW8270C	Groundwater	9	1	0	0	1	0	8
	SW6010B	Groundwater	9	1	0	0	1	0	8
	SW7470A	Groundwater	9	1	0	0	1	0	. 8
A0C 17	SW8260B	Groundwater	4	1	1	1	1	2/2	12
	SW8270C	Groundwater	4	1	0	0	1	7/7	10
	SW8080A	Groundwater	4	1	0	0	1	2/2	10
	SW8141A	Groundwater	4	1	0	0	1	7/7	10
	SW8151A	Groundwater	4	1	0	0	1	7/7	10
	SW8280A	Groundwater	4	1	0	0	1	7/7	10
	SW9012A	Groundwater	4	1	0	0	1	2/2	10
	SW9030A	Groundwater	4	1	0	0	1	7/7	10
	SW6010B	Groundwater	4	1	0	0	I	7/7	10
	SW7470A	Groundwater	4	1	0	0	1	7/7	10
A0C 18	SW8260B	Groundwater	0	0	0	0	0	0	0
	SW8270C	Groundwater	0	0	0	0	0	0	0
	SW6010B	Groundwater	0	0	0	0	0	0	0

# Table 3.13 (continued) Groundwater Sample Analysis Summary NAS Fort Worth JRB, Texas

			No. of	No. of Equipment	No. of Ambient	No. of Trip	No. of Field	No. of	Total No. of
Site	Method	Matrix	Samples <sup>1</sup>	Blanks	Blanks4	Blanks <sup>5</sup>	Duplicates <sup>6</sup>	MS/MSD'	Samples <sup>2</sup>
AOC 18 (cont'd)	SW7470A	Groundwater	0	0	0	0	0	0	0
40C 19	SW8260B	Groundwater	1	1	1	1	1	0	5
	SW8270C	Groundwater	1	1	0	0	1	0	3
	SW6010B	Groundwater	1	1	0	0	1	0	£
	SW7470A	Groundwater	1	1	0	0	1	0	3

Notes:

Monttoring well to be sampled for three consecutive rounds 2 months apart

The number of samples is based on the number of samples collected during each sampling event, and on the assumption that there will be enough water in each well to purge and sample actual number of groundwater samples collected may vary depending on seasonal groundwater fluctuations.

A maximum of one equipment blank will be taken per day. One equipment blank will be taken per day, per analysis (for example, 3 equipment blanks represents 1 sample/day for 3 days) Ambient blanks for VOCs will only be sampled if VOCs are detected by the PID during the sampling effort. One ambient blank will be collected at the beginning of the field investigation for

One trip blank will accompany each cooler that contains samples to be analyzed for VOCs. Trip blanks will only be analyzed for VOCs.

Field Duplicates will be collected on a 10% basis of investigation samples.

MS/MSDs will be collected on a 5% basis of investigation samples.

groundwater.

Table 3.14
General Specifications for Monitoring Wells
Associated with SWMUs 19, 20, and 21

Well I.D.	Measuring Point Elevation (ft above MSL)	January 1999 Groundwater Elevations (ft above MSL)	Screened Elevations (ft above MSL)	Total Depth (feet)	Screened to Bedrock
FT09-12A	635.66	618.59	619-609	25	yes
FT09-12B	627.55	595.78	598.1-588.1	40	, yes
FT09-12C	628.05	595.69	598-588	38	yes
FT09-12D	627.45	596.18	603.4-590.4	35.4	no
FT09-12E	627.48	595.66	600.5-597	38.5	yes

### Notes:

ft above MSL = feet above mean sea level Groundwater data from HydroGeoLogic, 1999. Monitor well data from Radian, 1989.

Table 3.15
1985 Surface Soil Analytical Results Summary
SWMU 53
NAS Fort Worth JRB, Texas

	Parameter	neter						Soil F	Soil Boring						
Compound <sup>1</sup>	BG/PQL (mg/kg)	MSC (mg/kg)	13A (0 ft)	13B (0 ft)	13B (2 ft)	13C (0 ft)	13C (2 ft)	13D (0 ft)	13D (2 ft)	13E (0 ft)	13F (0 ft)	13F (2 ft)	13G (0 ft)	13H (0 ft)	131 (0 ft)
Metals*															
Arsenic	5.855	5.855	ND	ND	Ð.	ND	QN	ND	QN	NA	AN	ΩŽ	QN	A A	0.19
Вагиш	233	233	1.1	1.0	1.0	0.89	0.86	1.1	1.2	NA	0.99	0.94	0.38	NA	0 37
Cadıum	0 5562	0 5562	ND	0 023	ND	0.031	Ð	ΩN	ΩŽ	NA	0 03	Q	ND	NA	0.007
Сһгошиш	21 056	21.056	ND	900.0	0 007	ND	QN	QN	ΩŽ	NA	ND	QN	QN	NA	0.022
Lead	30.97	30.97	ΩN	ND	ND	ND	ND	ND	Q.	NA	QN	QN	ND	NA	0.12
Mercury	0.14	0.2	0.0003	0.0007	0 0004	0.0003	0 0003	0.0003	0.0004	NA	0.0016	0 0004	0 0000	NA	0 13
Selenium	0 9072	5	Q.	ND	QN	ND	ND	ND	ND	NA	ND	QN	ND	NA	0.18
Silver	0.213	51	QN	ND	QN	Q	ND	ND	QN	NA	ND	QN	QZ	AN	0 027
Organic Indicators*	tors*			-											
Oil & Grease	10	NV	510	ND	QN	09	QN	650	ND	, 08	30	1300	ND	270	69

Notes:

Shaded boxes show results above the BG/PQL.

BG =Background Concentrations (Jacobs, 1998)

MSC= Medium-specific concentrations for industrial use based on groundwater protection

NA = Not Analyzed

ND = Not Detected

NV = No Value

PQL = Practical Quantitative Limit

= Only compounds with detectable concentrations are reported.

\*Analytical methods not reported

₹re

## 1985 Subsurface Soil Analytical Results Summary NAS Fort Worth JRB, Texas SWMU 53

	Parameter	ıeter					Soil Boring				
Compound <sup>1</sup>	BG/PQL (mg/kg)	MSC (mg/kg)	13B (4 ft)	13C (4 ft)	13C (6 ft)	13D (4 ft)	13D (6 ft)	13D (8 ft)	13F (4 ft)	13F (6 ft)	13F (8 ft)
Metals*											
Barium	128.1	200	0.91	0.72	0.45	0.78	0.66	0.54	NA	NA	NA
Chromium	16.31	16.31	QN	ND	QN	0.014	0.006	QN	NA	NA	NA
Mercury	0.035	0.2	0.0003	0.0016	0.0006	0.0004	ND	0.0011	NA	NA	A'A
Silver	0.1277	15	ΩN	ND	ND	0.005	ND	QN	NA	NA	NA
Organic Indicators*	ators*										
Oil & Grease	10	NV	CIN	ND	ND	ND	ND	ND	2000	160	1400

Shaded boxes with show results above the BG/PQL.

= Basewide background concentrations (Jacobs, 1998)

MSC = Medium-specific concentration for industrial use based on groundwater protection

= Not Analyze = No Value

= Practical Quantitative Limit

Only compounds with detectable concentrations are reported.

\*Analytical methods not reported

### Table 3.17 1985 Subsurface Soil Analytical Results Summary SWMU 68 NAS Fort Worth JRB, Texas

	Para	meter		Soil	Boring	
Compound <sup>1</sup>	PQL (mg/kg)	MSC (mg/kg)	17A (9-10 ft)	17A (14-15 ft)	17E (9-10 ft)	17E (14-15 ft)
Organic Indicator	s*					F
Oil & Grease	PQL	NV	170	170	1,300	170

### Notes.

MSC = Medium-specific concentration for industrial use based on groundwater protection

NV = No Value

PQL = Practical Quantitative Limit

Only compounds with detectable concentrations are reported.

\*Analytical method not reported

### Table 3.18 1985 Groundwater Analytical Results Summary SWMU 68 NAS Fort Worth JRB, Texas

	Parai	neter		Soil	Boring	
Compound <sup>1</sup>	PQL (mg/l)	MSC (mg/l)	17A	17B	17E	17H
Organic Indicators*						
Oil & Grease	1.0	NV	ND^	ND^	31,000	ND^
VOCs*						
Total Organic Carbon	PQL	NV	77	190	44	55
Total Organic Halides	PQL	NV	0.01	< 0.1	< 0.01	< 0.01

### Notes:

MSC = Medium-specific concentration for industrial use

NV = No Value

PQL = Practical Quantitative Limit

= Only compounds with detectable concentrations are reported.

\* = Analytical methods not reported

\* = Values are not reliable, interference suspected in analysis

Table 3.19
1988 Surface Soil Analytical Results Summary
SWMU 53
NAS Fort Worth JRB, Texas

							Soil Boring	ng				
	Parameter	neter		Ma	March 05, 1988				W	March 31, 1988	88	
Compound	BG/PQL (mg/kg)	MSC (mg/kg)	13G* (0 ft)	13H* (0 ft)	13I* (0 ft)	13J (0 ft)	13K (0 ft)	13G* (0.1 ft)	13H* (0.1 ft)	13I* (0.1 ft)	13J (0.1 ft)	13K (0.1 ft)
Metals (6010)								-				
Silver	0.213	51	<0.76	1.3	< 0.83	1.0	<0.84	< 0.89	< 0.90	<0.87	< 0.89	< 0.88
Aluminum	22035	22035	9500.0 B+	0 00001	13000 0	8200.0	12000 0	11000.0	14000.0	14000.0	9300 0	12000.0
Arsenic	5.855	5 855	50.0 R	0 09	<28.0	0.09	70.0	< 30.0	< 30 0	< 29 0	< 30 0	< 29 0
Barıum	233	233	63 0 R	160.0	55 0	310.0	630.0	260 0↑	55.0	099	290.0	160.0
Beryllium	1.02	0.4	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.3	0.2	0.2
Calcium	167788	167788	8 0 00098	45000.0	0 00019	0 00088	85000.0	91000.0	87000.0	59000 0	0 00099	63000.0
Cadmium	0.5562	0 5562	. 20	0.0	9.0	3.0	1.2	0.1	0.6	1.7	6.0	1.0
Cobalt	11.05	019	2.9	2.5	4.5	3.3	5.1	2.7	2 0	3.0	1.5	17
Chromium	21.056	21.056	27.0	17.0	15.0	26.0	16.0	27.0 +	16.0	24.0	20.0	22.0
Copper	17.373	130	_ 48	53	4.1	18.0	5.4	49	6.0	17.0	11 0	8.7
Iron	17717	11111	E 0 0069	0 0009	8300.0	7400.0	15000.0	7700 0	0.0068	11000 0	6700.0	8800.0
Potassium	2895	2895	0 0011	1200.0	1400.0	930 0	1700.0	1400.0	1700 0	1800 0	1100 0	1500 0
Magnesium	3003	3003	1600 0	1400.0	1700.0	1500.0	0 0061	1700 0	2100.0	2200 0	1500.0	1700.0
Manganese	849 1	1400	130.0R+	860	160 0	150 0	200 0↑	130 0	160.0	190.0	110.0	120.0
Sodium	25800	25800	70.0	35.0	88 0	110.0	67.0	<7.9	<80	<i>T.T&gt;</i>	23 0	<7.8
Nickel	14 6	200	6.0	09	9.0	7.0	10 0	6.0	6.0	8.0	6.0	60
Lead	30 97	30 97	64.0 R	31.0	21.0	58.0	14 0	58.0 R+	19.0	39.0	50.0	20 0
Antimony	0.56	90	13 0 R	15.0	10.0	20.0	14.0	8 5 R	09>	< 5.8	<5.9	< 5.9
Seleny	0.9072	5	40 0 R	30.0	40.0	30.0	50.0	44 0 R+	44.0	44.0	< 30 0	37.6

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Table 3.19 (continued)
1988 Surface Soil Analytical Results
SWMU 53
NAS Fort Worth JRB, Texas

												į
						i	Soil Boring	ing				
	Parameter	neter		M	March 05, 1988				N	March 31, 1988	88	
Compound	(BR/kg) TOA/SE	MSC (mg/kg)	(y 0) *5EI	13H* (0 ft)	13I* (0 ft)	13J (0 ft)	13K (0 ft)	13G* (0.1 ft)	13H* (0.1 ft)	13 <b>I*</b> (0.1 ft)	13J (0.1 ft)	13K (0.1 ft)
Sılicon	ΛN	AN	200 O R	290.0	250 0	310.0	200.0	280.0	210.0	250 0	210 0	260.0
Thallium	6 89	63.9	9.7>	23.0	26.0	21 0	20.0	<8.9	06>	<8.7	<8.9	< 8.8
Vanadium	46 26	72	23.0	18.0	26.0	24 0	29.0	24 0	27.0	28.0	21.0	25.0
Zinc	38.8	3100	33 0	34.0	47.0	58.0	34 0	46.0^	26.0	42.0	37.0	35.0
TPH (418.1)												
ТРН	90	5002	11300	1320.0	0 096	420.0	34.0	410.0	3500.0	0.66	230.0	55 0
VOCs (8240)												
2-Butanone	0.1	NV	< 0.18	< 0.040	< 0.039	<0.035	<0.034	63B	<0.036	< 0.037	<0 035	0.024 J
4-Methyl-2-pentanone	0.1	NV	< 0.33	<0.073	< 0.072	<0.064	<0.062	0.21 BJ	<0.066	<0.068	<0.064	<0.067
Вепzепе	0.1	0.5	0 011 J	0 0031 J	0.0075	0.0030 J	0 0038 J	< 0.80	<0 0063	<0.0065	0.0015 J	0 0025 J
Ethylbenzene	0.1	70	0.75	0 0111	0.017	0.0037 J	0 0041 J	<1.3	0.0030J	0.0021 J	0.0051 J	0 0044 J
Toluene	0.1	100	0.16	0 034	0 36	0 0083 J	0 012	3.0	0 023	0.018	0.095	0.11
Acetone	0.1	1000	0 020 BJ	0.088 B	0.036 B	0 011 B	<0.010	2.2 B	0.031 B	0.044 B	0 056 B	0.047B
Methylene chloride	0.1	0.5	<0 020	<0 0045	0 017 B	< 0 0039	0 0065 B	<0.51	0 006 B	0 0044 B	0.013B	0 0016 J
Total Xylenes	0.1	1000	3.9	0 063	0.15	0 020	0.028	<0.83	0 018	0 014	0 036	0 021
SVOCs (8270)												
2,4-Dimtrotoluene	1.0	0 042	< 1.0	<1.0	<0.59	0.29 J	< 0.51	<0.57	<25.0	< 0.47	< 0.52	<0.50
2-Methyinaphthalene	1.0	410	3.2	1.4 J	0 42 J	2.3	0 46 J	0.11 J	5.0 J	0 51 J	3.1	0.21 J
4-Methylphenol	1.0	NV	1.0.1	<1.8	<10	<0.91	< 0 90	1.5	<44.0	0 22 J	<0.92	<0.88
Acenaphthene	1.0	610	0.56	<0 33	0 34	0 23	< 0.17	< 0.19	<8.4	0 78	0 25	0.29

Table 3.19 (continued)
1988 Surface Soil Analytical Results
SWMU 53
NAS Fort Worth JRB, Texas

							Soil Boring	gu				
	Parameter	ıeter		ME	March 05, 1988				W	March 31, 1988	88	
Compound	BG/PQL (mg/kg)	MSC (mg/kg)	13G* (0 ft)	13H* (0 ft)	131* (0 ft)	13J (0 ft)	13K (0 ft)	13G* (0.1 ft)	13H* (0.1 ft)	13I* (0.1 ft)	13J (0.1 ft)	13K (0.1 ft)
Acenaphthylene	1.0	610	<0.61	0.19 J	<0.36	0.12 J	<0.31	<0.35	< 15.0	<0.29	<0.32	0.11 J
Anthracene	10	3100	1.2	<033	1.1	0.24	<0 17	0 11 J	<8.4	2.4	0.43	1.5
Benzo(a)anthracene	10	0.039	3.9	0.57 J	3.2	0.53 J	<0.70	0.41 J	<35.0	5.4	1.3	8.2
Benzo(a)pyrene	1.0	0.02	6.2	0.89	5.9	0 86	<0.22	0.74	<11.0	7.6	2.1	12.0
Benzo(b)fluoranthene	1.0	0 039	< 0.84	< 0.84	7.0	<0.44	<043	0.66	<21.0	5.5	2.0	86
Benzo(k)fluoranthene	10	0 39	8.5	1.1	3.6	1.1	< 0 22	0.55	<11.0	5.1	1.6	13.0
Benzoic Acid	1 0	41000	<8.8	< 8.8	<5.2	<46	<4.5	0 25 J	< 220.0	<4.1	0 27 J	< 4.4
Bis(2- ethylhexyl)phthalate	10	9.0	3.5	23.0	2.6	2.7	0 34	1.5 B	<11.0	2.1 B	2.2 B	2.4 B
Butylbenzyl Phthalate	1 0	2000	<0 44	<0 44	< 0.26	< 0.23	<0.22	0.41	4.3 BJ	0 14 J	0 143	0 13 J
Chrysene	1.0	3.9	6.2	0.93	4.3	0.72	<0.22	0.57	<11.0	5.4	1.5	8.1
Dibenzo(a,h)anthracene	1.0	0.02	1.2	< 0.44	1.2	< 0.23	< 0.22	<0.25	<11.0	0.58	0.30	1.8
Dibenzofuran	10	NV	0 37J	0.31 J	0.17 J	0.093 J	06 0 >	<10	<44.0	0.67 J	0.19 J	0.14 J
Fluoranthene	1.0	410	9.7	1.8	7.6	1.6	0 12 J	1.2	£.6>	6.6	3.6	140
Fluorene	1.0	410	0.51	0.44	0 32	0.23	< 0.17	<0 19	<8.4	1 2	<0.17	0.29
Indeno(1,2,3-cd)pyrene	1.0	390	3.3	034J	3.1	0 42	<0.33	0.45	<16.0	3.0	0 78	4.4
N- nitrosodiphenylamine	1.0	NV	<0.33	<033	<0.20	0 75	<0.17	<0.19	< 8 4	< 0.16	<0.17	<0 17
Naphthalene	1.0	200	1.4	0.37	0.17 J	0.25	0.097 J	<0.16	<7.1	0.77	0.38	0.13 J
Phenanthrene	10	310	4.4	1.7	3.9	0.91	<0.48	0 37 J	<24.0	8.4	1.9	5.1
Phenol	1.0	6100	<0.26	< 0.26	<0.16	<0 14	<0.13	0.20	99>	0.11.0	<0.14	0.088

### 1988 Surface Soil Analytical Results NAS Fort Worth JRB, Texas Table 3.19 (continued) **SWMU 53**

							Soil Boring	ing				
	Parameter	neter		Ms	March 05, 1988				M	March 31, 1988	88.	
	BG/PQL	MSC	13G*	13H*	131*	133	13K	13G*	•H€I	13I*	133	13K
Compound	(mg/kg) (mg/kg)	(mg/kg)	(0 ft)	(0 ft)	(0 ft)	(0 ft)	(0 ft)	(0.1 ft)	(0.1 ft)	(0.1 ft)	(0.1 ft)	(0.1 ft)
Pyrene	1.0	310	9.1	1.7	6.8	1 4	0 095 1	0.84	<8.4	12.0	33	10.0

Shaded boxes show results above the BG/PQL.

Shaded boxes with double borders show results above both the BG/PQL and the MSC BG = Background Concentrations (Jacobs, 1998)

= Estimated Value

= Medium-specific concentration for industrial use based on groundwater protection. = Not Detected MSC

= Practical Quantitative Limit = No Value 2 2

= Compound detected in reagent blank

 Only compounds with detectable concentrations are reported. = Matrix spike recovery is not within control limits

= Action level from TNRCC RG-17.

= Differentiates Radian 1988 soil borings from the Radian 1985 soil borings of the same name = % difference between the MS and MSD is not within control limits

= Duplicate analysis is not within control limits

### Table 3.20 1988 Subsurface Soil Analytical Results Summary SWMU 68 NAS Fort Worth JRB, Texas

	Paran	neter .	,	Monitori	ng Well	
Compound <sup>1</sup>	BG/PQL (mg/kg)	MSC (mg/kg)	17I (7-11 ft)	17I (11-13 ft)	17J (10-15 ft)	17K (10-15)
Metals (7420)				1		
Lead	12.66	12.66	4.1	9.6	2.4	11.0
TPH (418.1)				t		
ТРН	50	500²	240.0	1100.0	ND	ND
VOCs (8240)				and the state of t		
Benzene	0.1	0.50	ND	ND	0.0016 J	ND
Toluene	0.1	100	ND	ND	0.0016 J	0.0020 J
Acetone	0.1	1000	ND	0.040 BJ	0.010 B	0 0092 J

### Notes:

Shaded boxes with double borders indicate values above the BG/PQL and the MSC.

B = Contaminant detected in reagent blank

BG = Background Concentration (Jacobs, 1998)

J = Estimated Value

ND = Not Detected

MSC = Medium-specific concentration for industrial use based on groundwater protection

PQL = Practical Quantitative Limit

= Only compounds with detectable concentrations are reported.

<sup>2</sup> = Action level for course-grained soils from TNRCC RG-17

### Table 3.21 1988 Groundwater Analytical Results Summary SWMU 68 NAS Fort Worth JRB, Texas

					Monitor	ing Well		
	Paran	neter	_	March 1988	-		April 1988	_
Compound <sup>1</sup>	BG/PQL (mg/l)	MSC (mg/l)	171	17J	17K	171	17J	17K
Metals (200.7)					-			
Aluminum	11.07	100	320.0	76.0	250.0	120.0	150.0	190.0
Antimony	0.0024	0.006	0.80	0.28	0.48	0.11	0.53	0.21
Barium	1.133	2.0	2.2	0.76	2.0	1.0	1.2	1.3
Beryllium	0.0019	0.004	0.035	0.0050	0.027	0.0050	0.0070	0.0080
Calcium	2438	2438	2800.0 E	1700.0 E	2500.0 E	1400.0	2900.0	1800.0
Cadmium	0.0016	0.005	0.015	< 0.0030	0.012	0.011	0.010	0.0090
Chromium	0.0136	0.1	0.58 E	0.15 E	0.45 E	0.24	0.25	0.31
Cobalt	0.01	6.1	0.24 E	0.013 E	0.16 E	0.12	0.030	0.10
Copper	0.0101	1.3	0.47	0.075	0.31	0.21	0.14	0.21
Iron	7.234	7.234	370.0 E	58.0 E	300.0 E	160.0	92.0	200.0
Lead	0 0016	0 015	0.64	0.11	0 40	0.23	0.17	0 22
Magnesium	68.78	68.78	62.0 E	20.0 E	51 0 E	31.0	30.0	38.0
Manganese	10.57	14	3 1	0.50	4.4	1 4	0.83	2.7
Nickel	0.0364	2.0	0.48	0.041	0.35	0.23	0.14	0.27
Potassium	3.9	3.9	45.0	12.0	36.0	18.0	22.0	26.0
Selenium	0.0072	0.05	1.0	< 0.30	0.88	0.70	0.70	1.0
Silicon	NV	NV	110.0	100.0	100.0	110.0	140.0	58.0
Silver	0.0003	0.51	0.0090	< 0.0090	0.010	< 0.0090	0.026	< 0.0090
Sodium	176.2	176 2	25.0 E	13.0 E	30.0 E	27.0	15.0	32.0
Thallium	0.0632	0.0632	< 0.090	< 0.090	< 0.090	<0.090	0.10	< 0.090
Vanadium	0.0653	0.72	1. <u>6</u> E	0.29 E	1.1 E	0.75	0.39	0.79
Zinc	0.0682	310	1.6 E	0.23 E	0.85 E	0.74	0.37	0.58

### Table 3.21 (continued) 1988 Groundwater Analytical Results Summary SWMU 68 NAS Fort Worth JRB, Texas

				_	Monitor	ing Well		
	Paran	neter		March 1988	3		April 1988	
Compound <sup>1</sup>	BG/PQL (mg/l)	MSC (mg/l)	17I	17J	17K	171	17J	17K
Water Quality Indicators 2					T.		; ;	
Arsenic, graphite AA	0.004	0.05	0.13	0.072	0.11	0.10	0.062	0.10
Chloride	1	NV	27.0	12.0	27.0	31.0	14.0	36.0
Fluoride	0.1	NV	0.22	0.19	0.24	0.24	0.23	0.24
Lead, graphite AA	0.000005	0.015	0.40	0.10	0.30	0.21	0.096	0.18
Mercury	0.0002	0.002	ND	ND	ND	ND	0.00020^	ND
Sulfate	1	NV	9.1_	7.0	17.0	8.0	7.0	15.0
Total Dissolved Solids	10	NV	980.0	620.0	810.0	530.0	490.0	610.0
TPH (418.1)					) }			
ТРН	1	<b>5</b> <sup>3</sup>	3.5	4.3	ND	2.3	ND	ND
Purgeable Halocarbons (60	)1)				r }			
Trichloroethene	0.00002	0.005	< 0.0002	<0.0002	<0.0002	< 0.0002	< 0.0002	0.0002
Purgeable Aromatics (8020	))				). L. E.		•	
Benzene	0.0002	0.005	0.054	ND	0.0016	ND	ND	0.0019
Ethylbenzene	0.0003	0.7	ND	ND	ND	ND	0.120	ND
Toluene	0.0002	61	ND	ND	0.0018	ND	0.046	0.0032
M-Xylene	0.0002	10	ND	ND	ND	ND	ND	0.00040
P-Xylene	0.0002	10	ND	ND	ND	ND	ND	0.00030
Extractable Priority Pollut	ants (625)			_	L			-
2-Methylnaphthalene	0.050	4.1	0.0240	NA	NA	0.014	NA	NA
Bis(2-ethylhexyl)phthalate	0 050	0.006	ND	NA	NA	0.0020 J	NA	NA
Butylbenzylphthalate	0.050	20	ND	NA	NA	0.0080 B	NA	NA
Di-n-butylphthalate	0.050	10	0.0034	NA	NA	ND	NA	NA
Naphthalene	0.050	2	0.0320	NA	NA	0.0240	NA	NA

Notes:

Shaded boxes show results above the BG/PQL

Shaded boxes with double borders show results above the BG/PQL and the MSC.

<sup>=</sup> Only compounds with detectable concentrations are reported.

### Table 3.21 (continued) 1988 Groundwater Analytical Results Summary SWMU 68 NAS Fort Worth JRB, Texas

<sup>2</sup> = EPA methods 206.3, 325.3, 240.2, 239.2, and 245.1

a Action level from TNRCC RG-17
 b = Analyte detected in reagent blank

BG = Background Concentrations (Jacobs, 1998)

J = Estimation based upon QC data

E = Estimated value due to presence of an interferant MSC = Medium-specific concentration for industrial use

NA = Not Analyzed NV = No Value

PQL = Practical Quantitative Limit

= Duplicate analysis was not within control limits

### Table 3.22 1993 Surface Soil Analytical Results Summary SWMU 53 NAS Fort Worth JRB, Texas

	Paran	neter			Sample Ni	ımbers		·
Compound <sup>1</sup>	PQL (mg/kg)	MSC (mg/kg)	DFLD-1 (0.5)	DFLD-5 (0.5)	DFLD-6 (1.5)	DFLD-9 (0.5)	DFLD- 10 (1.5)	DFLD- 11 (0.5)
VOCs (8020)		_						
Benzene	0.002	0.5	ND	ND	ND	ND	ND	ND
Ethylbenzene	0.002	70	ND	0.0028	ND	0.002	ND	ND
Toluene	0.002	100	ND	ND	ND	ND	ND	ND
Xylenes	0.002	1000	ND	0.012	0.0038	0.011	0 0065	ND
BTEX	0.002	NV	ND	0.0148	0.0038	0.013	0.0065	ND
TPH (418.1)				<u>-                                      </u>	_	1		
ТРН	10	500²	120	20	37	ND	ND	93

### Notes:

Shaded boxes show results above the PQL.

Shaded boxes with double borders show results above the PQL and the MSC.

MSC = Medium-specific concentrations for industrial use based on groundwater protection

ND = Not Detected

PQL = Practical Quantitative Limit

Only compounds with detectable concentrations are reported.

= Action level for course soils from TNRCC RG-17

Source: Dames & Moore, 1995

### **Table 3.23** 1993 Surface Soil Analytical Results Summary **SWMU 52** NAS Fort Worth JRB, Texas

	Parai	neter		Soil Boring	
Compound <sup>1</sup>	BG/PQL (mg/kg)	MSC (mg/kg)	1190-SB01 (0-2 ft)	1190-SB02 (0-2 ft)	1190-SB03 (0-2 ft)
Metals (6010)					
Aluminum	22035	22035	5600 J	6600	10000
Arsenic	5.855	5.855	4.4	4.3	7.6
Barium	233	233	61 J	57	76
Beryllium	1.02	1.02	< 0.18	< 0.16	0.33
Cadmium	0.5562	0.5562	5.4 J	2.1	3.6
Calcium	167788	167788	150000	87000	46000
Chromium	21.056	21.056	17 J	9.8	11
Cobalt	11.05	6100	3.1	2.5	5.2
Copper	17.373	1300	19 J	5 1	5.9
Iron	17717	17717	7600	6800	12000
Lead	30.97	30.97	88 J	10	12
Magnesium	3003	3003	1400	1100	160
Manganese	849.1	14000	200	92	260
Nickel	14.6	200	7.6	5.8	10
Potassium	2895	2895	870 J	680	1,200
Selenium*	0.9072	5	< 7.0	< 6.2	< 6.5
Silver*	0.213	51	<7	< 0 62	< 0.66
Sodium	25800	25800	67	39	45
Vanadium	46.26	72	16	20	19
Zinc	38.8	3100	46 J	18	17
VOCs (8240)	-		-		-
Methylene chloride	PQL	0.5	0.016	0.002 JB	0.011

Notes:
Shaded boxes show results above the BG/PQL.
Shaded boxes with double borders show results above both the BG/PQL and the MSC
BG = Background Concentrations (Jacobs, 1998)
J = Estimated Value
Medium-specific concentration for industrial use based on groundwater prof

J = Estimated Value
MSC = Medium-specific concentration for industrial use based on groundwater protection
NV = No Value

Only compounds with detectable concentrations are reported

Concentrations could not be quantified below the MSC and/or the BG/PQL
Source Law, 1995

### **Table 3.24 General Specifications for Select Monitoring** Wells Associated with SWMU 53 NAS Fort Worth JRB, Texas

Well I.D.	Measuring Point Elevation (ft above MSL)	January 1999 Groundwater Elevations (ft above MSL)	Screened Elevations (ft above MSL)	Total Depth (ft)	Screened to Bedrock
ST14-25	592.94	586.83¹	585.94-575.94	17.0	Yes
ST14-W08	580.54	569.21	573.54-555.54	26.1	No
ST14-W09	575.54	566.09	568.54-554.54	22.0	No
ST14-W12	575.52	568.57	569.52-557.52	19.1	No
17I	578.13	566.08	575.79-561.63	20	Yes
1 <b>7</b> J	579.94	567.15	572.49-553.29	21	No
17K	575.34	575.47 <sup>1</sup>	566.64-562.24	19	Yes

Notes:

ft above MSL = feet above mean sea level

Groundwater Elevation is above the screened interval Source: HydroGeoLogic, 1999a and Radian, 1989.

### **Table 3.25** 1997 Surface Soil Inorganic Analytical Results Summary **AOC 19** NAS Fort Worth JRB, Texas

	Parai	neter		Sample !	Yumber	_
Compound!	BG (mg/kg)	MSC (mg/kg)	THGLTA022-01 (0-0.5')	THGLTA023-01 (0-0.5')	THGLTA025-01 (0-0.5')	THGLTA027-01 (0-0.5')
Metals (6010A	, 7410)					
Antimony	0.56	0.6	0.96 J	2.0 J	1.2 J	ND
Barium	233	233	510 J	3620	3900 J	ND
Cadmium	0.5562	0.5562	0.65 F	5.4	0.81 J	0.64 J
Calcium	167788	167788	ND	ND	174000	ND
Chromium	21.056	21.056	28 1 J	63.5	56.4 F	ND
Соррег	17.373	130	ND	47.6 J	ND	ND
Lead	30.97	30.97	325 J	519 J	387 J	68.8 J
Mercury	0.14	0.2	ND	0.43	ND	ND
Zinc	38.8	500	84.4 J	419 J	64.4 J	40.6 J

### Notes:

Shaded boxes show results above background.

Shaded boxes stable testits above background.

Shaded boxes with double borders show results above both the background and the MSC.

BG = Background Concentrations (Jacobs, 1998)

ND = Not Detected

MSC = Industrial use based on groundwater protection

The analyte was positively identified; the value is an estimate.
 The analyte was positively identified, but the associated numerical value is below the practical reporting limit.

Only compounds with detectable concentrations are reported. Source: HydroGeoLogic, 1997

### **Table 3.26** 1997 Surface Soil Organic Analytical Results Summary AOC 19 NAS Fort Worth JRB, Texas

			Sample 1	Number
Compound <sup>1</sup>	PQL (mg/kg)	MSC (mg/kg)	THGLTA022-01 (0-0.5)	THGLTA023-01 (0-0.5)
SVOCs (8270B)			•	
Benz(a)anthracene	NV	0.039	2.7	0.85
Benzo(a)pyrene	NV	0.02	2.8	1.4
Benzo(b)fluoranthene	NV	0.039	4.3	2.5
Benzo(ghi)perylene	NV	310	1.6	0.95
bis(2-Ethylhexyl) phthalate	NV	0.6	0.81	ND
Chrysene	NV	3.9	3.1	1.2
Fluoranthene	NV	410	5.2	1.5
Indeno(1,2,3-cd)pyrene	NV	0.039	1.7	0.99
Phenanthrene	NV	310	3.1	ND
Pyrene	NV	310	4.2	1.4

### Notes:

Shaded boxes with double borders show results above both the background and the MSC.

MSC = Medium-specific concentration for industrial use based on groundwater protection

ND = Not Detected NV = No Value

PQL = Practical Quantitative Limit

Only compounds with detectable concentrations are reported.

Source: HydroGeoLogic, 1997

1997 Subsurface Soil Inorganic Analytical Results Summary AOC 19 NAS Fort Worth JRB, Texas **Table 3.27** 

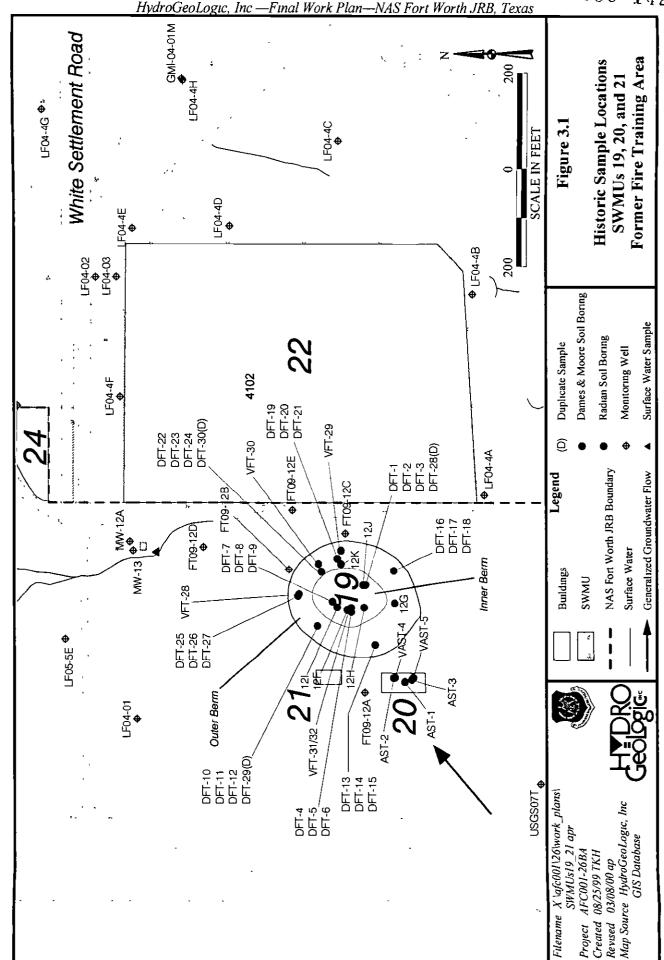
	Parameter	neter			Sample	Sample Number		
Compound	BG (mg/kg)	MSC (mg/kg)	THGLTA021-02 (9.5-10')	THGLTA022-02 (11-11.5')	THGLTA024-02 (14.5-15')	THGLTA025-02 (10.5-11')	THGLTA027-02 (3-3.5')	THGLTA028-02 (8.5-9')
Metals (6010A, 7410)	7410)							
Arsenic	5.533	5.533	ON	QN .	QN	7.9 J	Ð	Q
Вапит	128.1	200	QN	QN	145 J	QN	QN.	Ø
Calcium	272000	272000	CIN	ND	ND	ND	ND	323000
Chromium	16.31	16.31	UD	MD	17.3 F	ND	18 O F	Ø
Cobalt	161.9	019	6.4 F	6.8 F	QN	ND	QN	QN
Lead	12.66	12.66	QN	ND	ON.	ND	136 J	ND
Manganese	351.7	351.7	ND	519 J	ND	ND	QN	ND
Potassium	1111	1717	ND	1950 J	ND	1820 J	QN	ND
Selenium	0.313	5	0.59 J	ND	QV	ND	2.0 F	ND
Zinc	31.27	3100	ND	ND	39.5 J	ΩN	80.4 J	ND

Notes:
Shaded boxes show results above background.
Shaded boxes with double borders show results above both the background and the MSC.
Shaded boxes with double borders show results above both the background and the MSC.

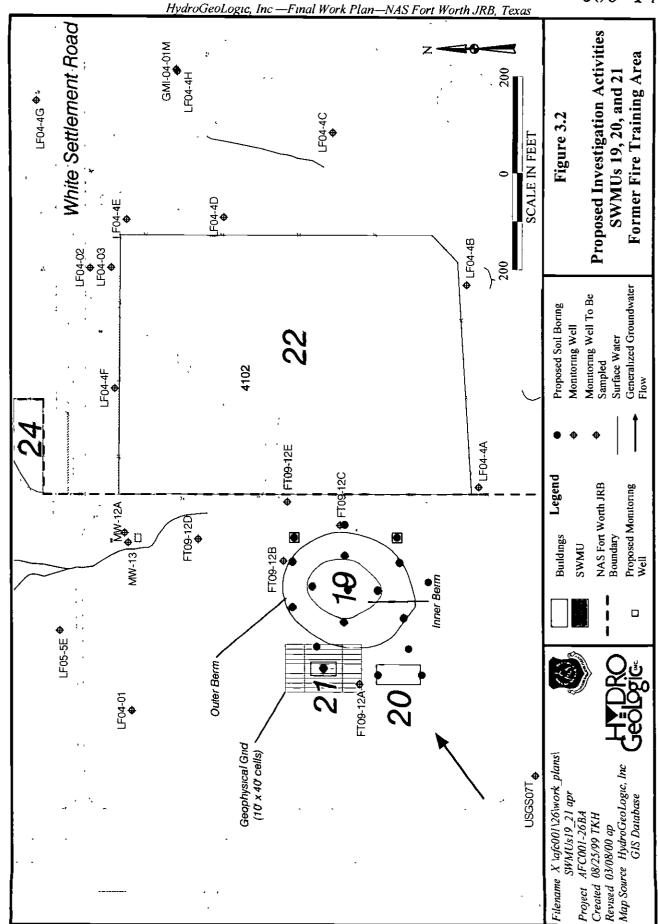
BG = Background Concentrations (Jacobs, 1998)
MSC = Industrial use based on groundwater protection
MD = Not Detected
ND = Not Detected
J = The analyte was positively identified, the quantitation is an estimate.
F = The analyte was positively identified, but the associated numerical value is below the practical reporting limit.
F = The analyte was positively identified, but the associated numerical value is below the practical reporting limit.

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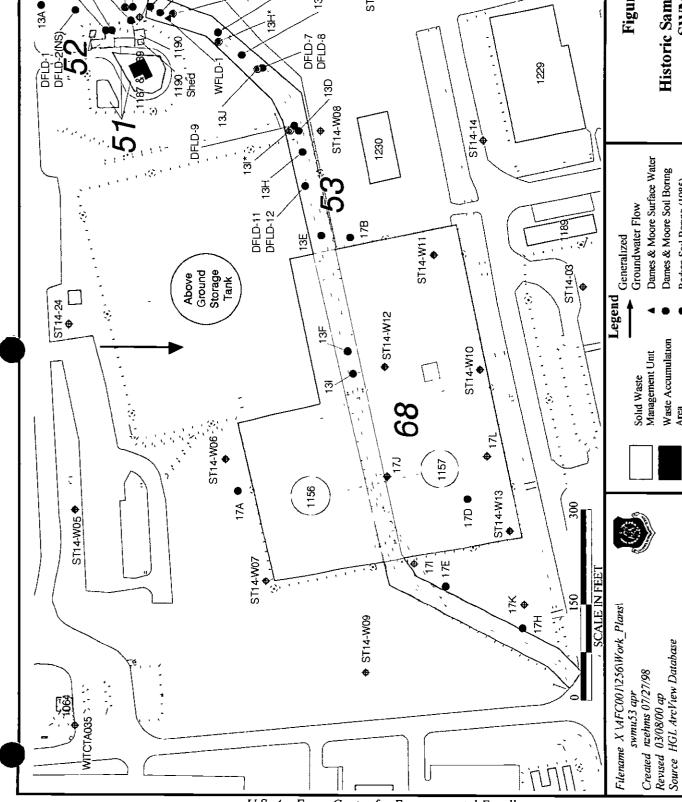
Figures



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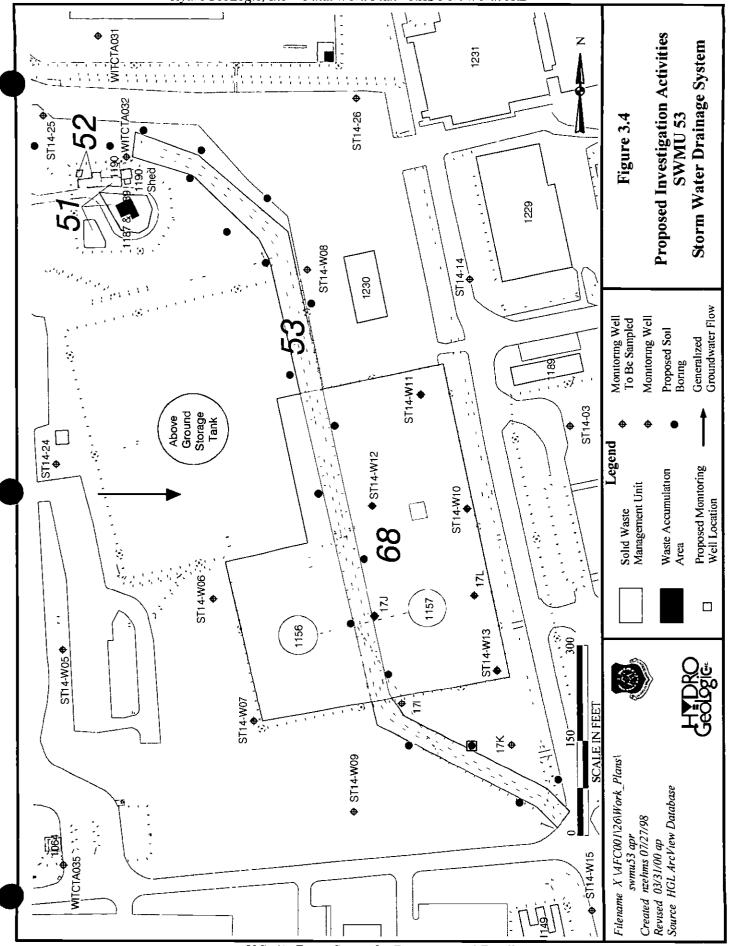
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OFLD-5 OFLD-6

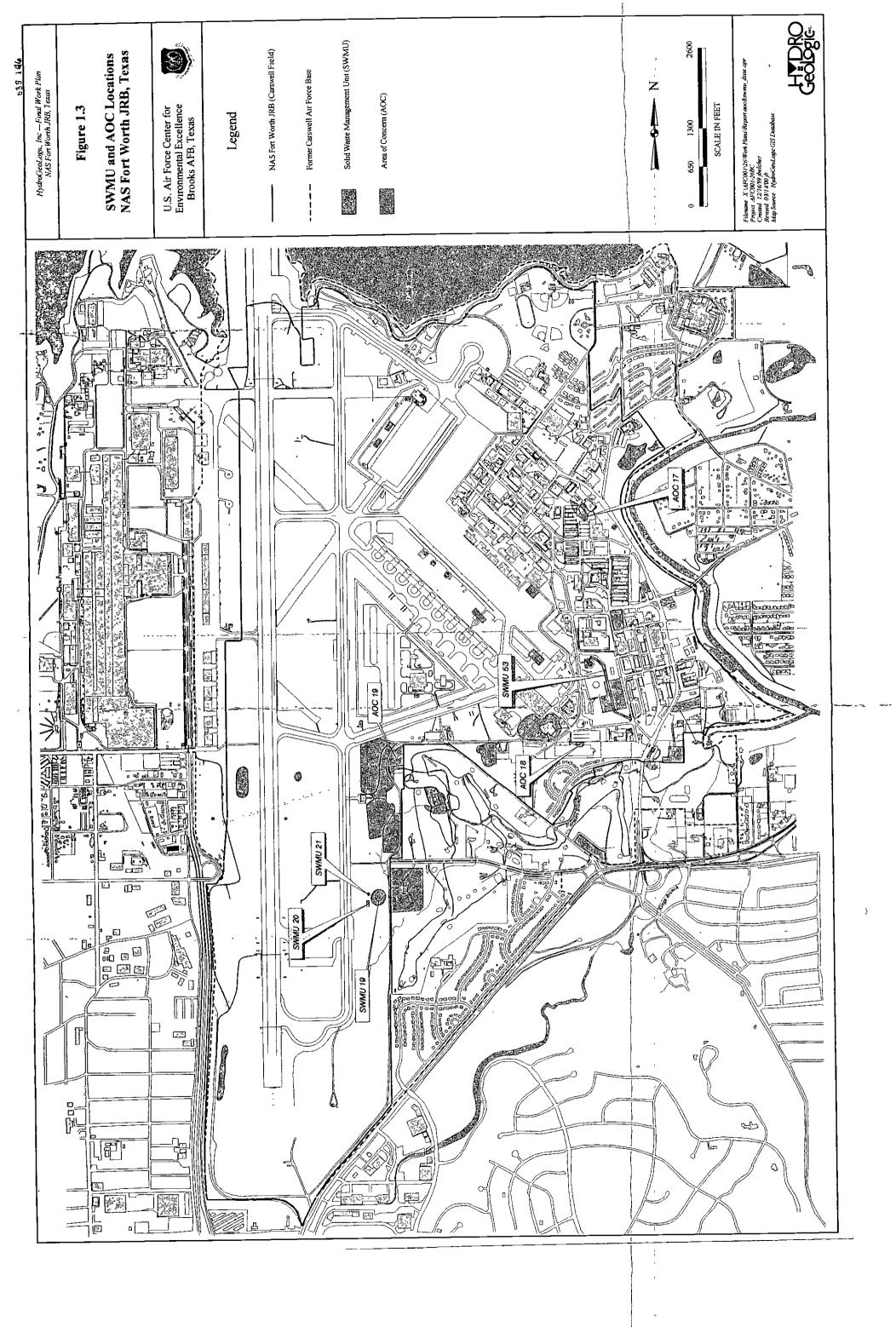
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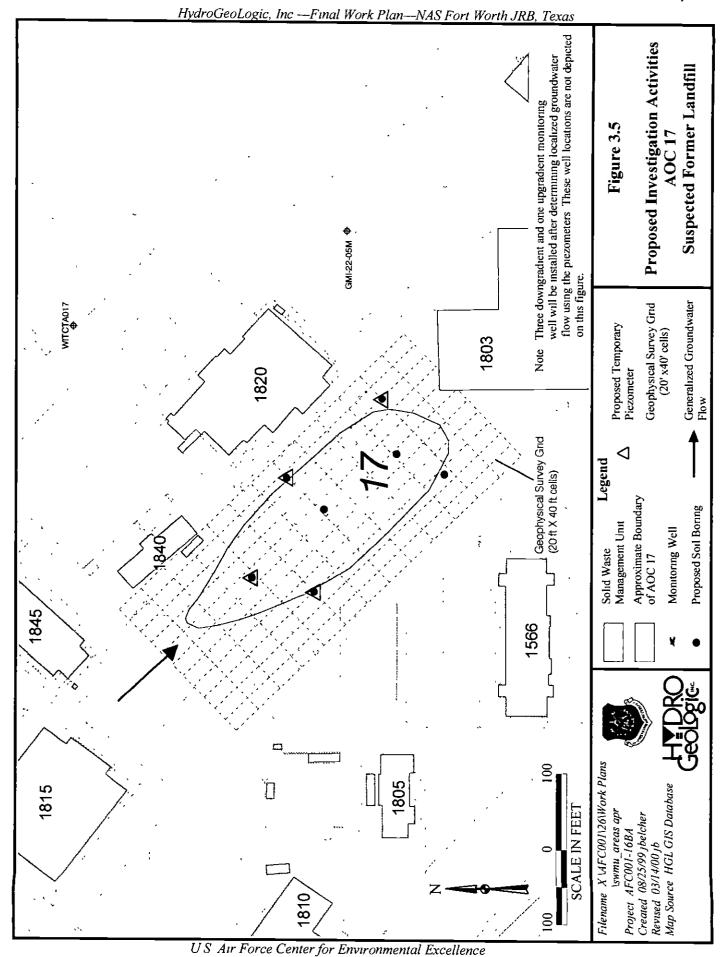
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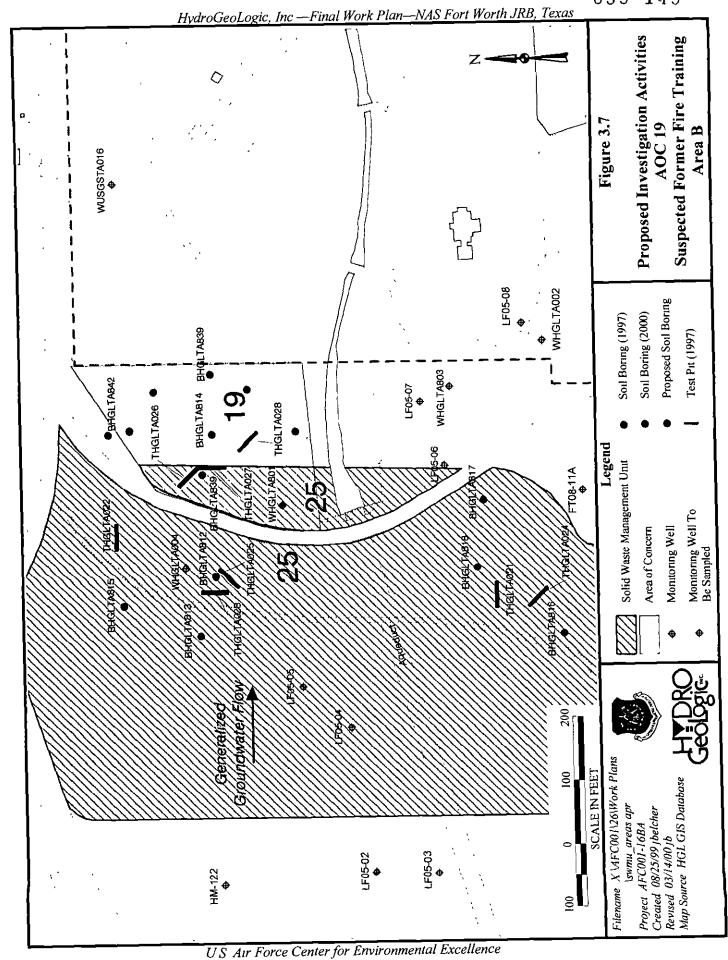
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Section 4

### 4.0 RISK ASSESSMENT

A brief description of the methods proposed for conducting human health and ecological risk assessment (ERA) tasks is provided in this section. Preliminary conceptual models have been developed to identify potential release and transport mechanisms, potential receptors, and exposure pathways associated with activities at the subject sites. The objective of the risk assessments is to characterize the potential risks associated with exposure to site media, and where the risks are unacceptable, to develop site-specific remediation goals protective of human health and the environment for use in the evaluation of remedial alternatives at the site.

### 4.1 HUMAN HEALTH RISK ASSESSMENT

The approach that will be used to assess human health risk at the SWMUs and AOCs is consistent with the EPA's Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part A) and Development of Risk-based Preliminary Remediation Goals (Part B) (EPA, 1989 and 1991b) and TNRCC's Risk Reduction Program (30 TAC 335, Subchapter S) (TNRCC, 1996b). Additional guidance may include State of Texas guidance for the closure of municipal landfills under RCRA Subtitle D (30 TAC Chapter 33, Subchapter J).

The TNRCC approach consists of three RRSs. RRS1 is based on background concentration levels and will serve as an initial screen for NFA site closures. RRS2 allows closure and/or remediation to health risk-based standards and criteria that are based on default assumptions concerning potential exposures. RRS2 will be used as a secondary screen for NFA site closures. If detected concentrations at the investigated SWMUs and AOCs exceed RRS1 and RRS2, site closure may proceed under RRS3. RRS3 consists in part of a BLRA, outlined in the following section, Section 4.1.1.

### 4.1.1 Technical Approach

If site closure cannot be completed because site concentrations exceed RRS1 and RRS2, baseline risk assessments in accordance with RRS3 will be prepared that will consist of the following five steps:

- 1. Data evaluation and identification of constituents of potential concern
- 2. Exposure assessment
- 3. Toxicity assessment
- 4. Risk characterization
- 5. Development of site-specific remediation goals (i.e., media cleanup requirements for RRS3).

### Step 1: Data Evaluation and Identification of Chemicals of Potential Concern

Data will first be evaluated to assess the achievement of data quality objectives for the project. The chemicals of potential concern (COPCs) will be those constituents detected in environmental media at the site at concentrations greater than background (RRS1) concentrations for metals, PQLs for organics, and risk-based screening levels (RRS2). The COPCs will be identified in

accordance with guidance provided by the TNRCC and the EPA. The COPCs are expected to be primarily organic and metal compounds.

### Step 2: Exposure Assessment

Exposure assessment estimates the magnitude, frequency, duration, and routes of exposure. An assessment may include current and future exposures. Exposure assessment involves three distinct processes: 1) characterizing the exposure setting, 2) identifying exposure pathways, and 3) quantifying exposure.

- Characterizing the Exposure Setting This step characterizes the exposure setting in terms of physical characteristics of the site and populations that might be exposed. Physical characteristics include climate, vegetation, groundwater, and surface water hydrology. Population characteristics include the location of receptors, the presence of sensitive subpopulations, and the activity patterns of current and future populations.
- Identifying Exposure Pathways This step identifies potential exposure pathways with respect to nearby populations. Exposure pathways are determined by the locations of sources, types of release mechanisms, types of contaminants, fate and transport mechanisms, and the locations and activities of the receptors.
- Quantifying Exposures This process is conducted in two steps: 1) estimation of exposure concentrations, and 2) calculation of intakes. Exposure concentrations are based on analytical data from the site. Chemical intakes are expressed in terms of mass of chemical intake per day per unit body weight. Intakes are calculated using standard equations that represent specific exposure pathways. Parameters include exposure concentration, fraction ingested, contact rate, exposure duration and frequency, body weight, and averaging time.

### Step 3: Toxicity Assessment

Toxicity assessment consists of two stages: hazard identification and dose-response assessment. Hazard identification evaluates whether or not a particular chemical can cause a particular health effect (such as cancer or birth defects) and if the adverse health effect occurs in humans. Hazard identification also evaluates the nature and strength of the evidence of causation. Dose-response assessment quantitatively evaluates toxicity information for the chemical to determine the relationship between the administered dose of the chemical to the incidence of a particular adverse effect in the exposed population. Toxicity values for carcinogens are expressed in units of cancer incidence per unit dose of the chemical; for noncarcinogens, the toxicity values are expressed in terms of a threshold value below which adverse effects are not expected to be observed.

The toxicity assessment will include an identification of critical toxicity values for the constituents of potential concern. A database search will be conducted to identify human and ecological toxicity values. The EPA's Integrated Risk Information System database and Health Effects Assessment Summary Tables will serve as the primary sources of human health toxicity values.

Additional toxicity data may be obtained through consultation with the TNRCC and EPA's National Center for Environmental Assessment. Ecological toxicity and/or benchmark values will be derived from the TNRCC documents and from the available scientific literature.

### Step 4: Human Health Risk Characterization and Uncertainty Analysis

The final stage of the BLRA process is risk characterization and uncertainty analysis. Therefore, the risk characterization step integrates information from the toxicity and exposure assessments to express risk quantitatively. Carcinogenic risk is calculated as the product of the chemical-specific slope factor and the chemical intake. The risk is expressed as a dimensionless number. Noncarcinogenic effects are expressed in terms of dimensionless numbers called hazard quotients. A hazard quotient is the ratio of the chemical intake and the chemical-specific reference dose. In the event that the receptor is exposed to multiple contaminants through multiple pathways, the combined risk (for carcinogens) and hazard indices (for noncarcinogens) are presented as the sums of individual risks and hazard quotients. An analysis of uncertainties associated with assumptions associated with the risk assessment will be presented.

### Step 5: Development of Risk Reduction Standards

Following the risk assessments, constituents that have an associated unacceptable noncarcinogenic and/or carcinogenic risk to humans and ecological receptors will be further addressed. Site-specific risk reduction standards will be developed, based upon cumulative risk, for such constituents detected in accordance with TNRCC and EPA guidelines.

### 4.2 ECOLOGICAL RISK ASSESSMENT

The ERAs will be conducted in accordance with the protocols presented in the TNRCC "Draft Guidance for Conducting Ecological Risk Assessments Under the Texas Risk Reduction Program" (TNRCC, 1996a). In particular, the TNRCC guidance suggests using a tiered approach for assessing ecological risks. It should be noted that, given the highly developed nature of the NAS Fort Worth JRB and surrounding areas, ecological impacts are not expected to be a primary issue at the base. The need for ERAs will be determined based on field observations and analytical results. ERAs are required for all closures under RRS3 and for some closures under RRS2.

As a first step, Tier 1 assessments (i.e., completing the ecological assessment checklist) will be conducted. Depending on the results of this first step, Tier II assessments (screening-level assessments) and/or Tier III assessments (quantitative assessments) may be conducted. If these subsequent tiers are undertaken, further information defining the methodologies and approaches to be used will be developed. In general, the overall strategy for conducting Tier II and Tier III ERAs will be consistent with the TNRCC guidance, the EPA guidance document "Ecological Risk Assessment for Superfund: Process for Designing and Conducting Ecological Risk Assessments" (EPA, 1996), and the "Tri-Services Procedural Guidelines for Performing Ecological Risk Assessments" (U.S. Department of Defense, 1996).

### 4.3 EXPOSURE SETTING

The potential release and transport pathways for each of the SWMUs and AOCs to be investigated in this study are similar. Each of the sites is generally covered with grass or pavement with adjacent or perimeter grass covered areas. Most of the sites are also adjacent to a storm water drainage ditch. The release pathways include runoff to surface water and leaching to groundwater.

### 4.4 RECEPTORS AND EXPOSURE SCENARIOS

This section represents an overview of the receptors and the potential exposure scenarios for the subject sites. To the extent that in many cases current and future receptors are, in fact, likely to be the same, their risks are already being considered under the "current" scenario. The receptor exposure scenarios in the conceptual model include:

- On-site Maintenance Worker Receptor This exposure assumes that a worker conducts activities on an intermittent or short-term basis. Exposure routes for this receptor may include the following:
  - Incidental ingestion of surface soil
  - Inhalation of fugitive dusts and volatile organics from the surface soil
  - Dermal contact with surface soil
  - Dermal contact with surface water and sediments
- On-site Worker This exposure assumes that a long-term employee is located at the site on a regular basis over their working career. Exposures for this receptor may include the following:
  - Incidental ingestion of surface soil
  - Inhalation of fugitive dusts and volatile organics from surface soil
  - Dermal contact with surface soil
  - Inhalation of volatile emissions in buildings that originated from soil
- On-site Construction Worker This exposure assumes that construction will occur on the site in the future allowing for a short-duration exposure scenario. Exposures for this receptor may include the following:
  - Incidental ingestion of soil
  - Inhalation of fugitive dusts and volatile organics in soil
  - Dermal contact with soil or surface water
- On-site Recreational Receptor This exposure assumes that the receptor (e.g., an older child or young adult) visits an area intermittently. This receptor would only be exposed to contaminants in surface water/sediments because the remaining units are secured due to military activities. The exposure routes evaluated for this receptor may include the following:

- Dermal contact and incidental ingestion of chemicals in the surface water and sediments
- Future Off-site Resident Receptor This exposure assumes that the receptor obtains all household water from private wells. Currently, the alluvial terrace groundwater unit does not impact any private wells. Additionally, there is no certainty that any private wells will be impacted in the future. Complete exposure pathways for groundwater will be determined subsequent to the evaluation of groundwater fate and transport to be conducted as part of the RFI. If it is determined that a future exposure pathway is complete for groundwater, then the exposure routes evaluated for this receptor may include the following:
  - Ingestion of groundwater
  - Inhalation of volatiles from groundwater
  - Dermal contact with chemicals in the groundwater
  - Ingestion of home-produced foodstuffs including fruits and vegetables
- Current and Future Ecological Receptors Exposures for these receptors may include the following:
  - Dermal contact with sediment and surface water
  - Ingestion of surface water
  - Incidental ingestion of sediments and soil
  - Dermal contact with soil

### 4.5 CONCEPTUAL SITE MODEL

The conceptual model provides a basis for identifying and evaluating the potential risks to human health in the BLRA. The conceptual model facilitates consistent and comprehensive evaluation of risks by creating a framework for identifying the paths by which humans and ecological receptors may be impacted by the subject SWMUs and AOCs at NAS Fort Worth JRB.

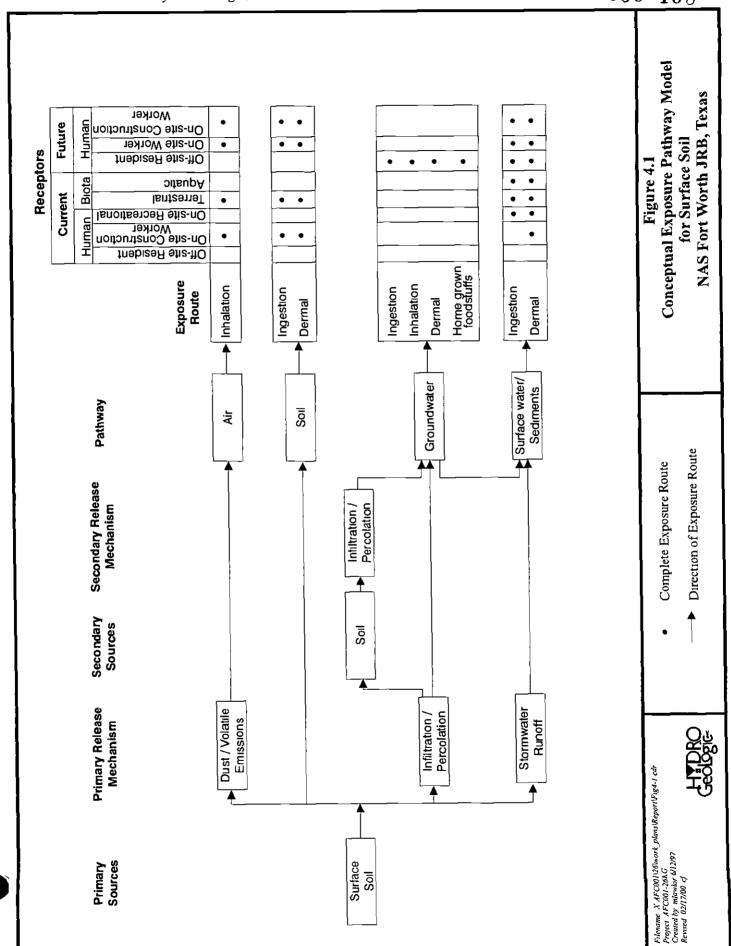
The elements necessary to construct a complete exposure pathway and to develop the conceptual model include:

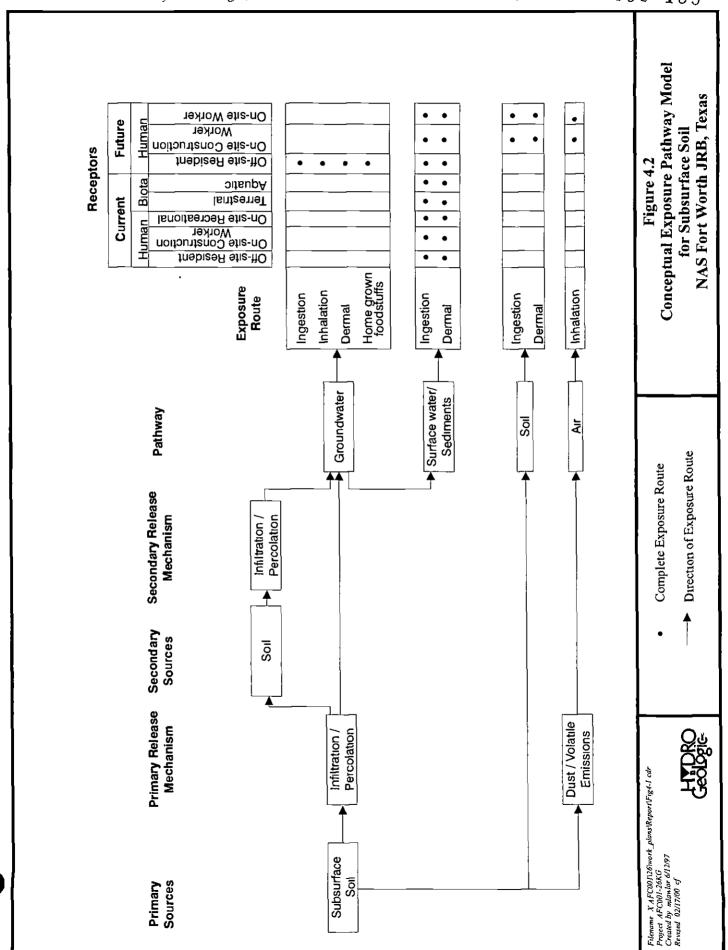
- Sources and COPCs
- Release mechanisms
- Transport pathways
- Exposure pathway scenarios
- Receptors

The conceptual site model for potential human environmental exposures to the soils, sediments, surface waters, and groundwater are summarized in Figures 4.1 and 4.2. Figure 4.1 pertains to contaminants contained in surface soil, while 4.2 pertains to contaminants in subsurface soils. This separation is significant because certain release mechanisms, and corresponding exposure scenarios, such as exposure to dust and volatile emissions from soil, are of concern only if

contaminants are, in fact, present in surface soil. If surface soil sampling to be conducted during the RFI does not show the presence of contaminants in surface soil, these exposure pathway scenarios can accordingly be eliminated from the BLRA.

Figures





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Section 5.0

### 5.0 CORRECTIVE MEASURES STUDY

If analytical results indicate contaminant levels above RRS2 cleanup levels, a CMS will be required in accordance with 30 TAC 335 Subchapter S Risk Reduction Standards. The purpose of the CMS is to develop and evaluate remedial alternatives to reduce risks to human health and the environment to acceptable levels as required for closure under RRS3. A BLRA will be performed as part of the CMS to indicate unacceptable threats to human health or the environment. If the sites are closed under RRS1 or RRS2, then a CMS will not be required.

### 5.1 CORRECTIVE MEASURES OBJECTIVES

Specific response objectives will be developed using applicable laws, regulations, and guidance, along with risk-based methods to define media specific cleanup levels that would reduce risks to the public health and environment to acceptable levels. Potential contaminant migration pathways and exposure pathways will be examined as a basis for estimating acceptable on-site residual contamination levels. Media-specific cleanup levels will be applied at the SWMU/AOC source area/boundary. Development of the CMS objectives will also include refinement of the applicable laws, regulations, and guidance specific to NAS Fort Worth JRB.

### 5.2 CORRECTIVE MEASURES ALTERNATIVES

Based on the objectives detailed in this work plan, a list of potential remedial alternatives have been developed and evaluated to address potentially contaminated media. Tables 5.1 and 5.2 summarize these alternatives for soil and groundwater, respectively. The alternatives that pass the initial screening process will be further evaluated and compared.

The listed remedial technologies and alternatives will be screened to eliminate from further consideration technologies and alternatives that are undesirable regarding implementability, effectiveness, and cost. The list of alternatives being considered will be narrowed by eliminating the following types of technologies:

- Technologies and alternatives that are not effective because they do not provide for the overall protection of human health and the environment, or do not comply with applicable laws, regulations, or guidance.
- Technologies and alternatives that are not implementable or technically applicable.
- Technologies/alternatives that are more costly than other technologies/alternatives, but do not provide greater environmental or public health benefits, reliability, or more permanent solutions. Costs alone will not be used to eliminate technologies, but may be used to select representative process options.

For each alternative that warrants further investigation, detailed documentation will be included to evaluate compliance with each of the objectives listed below.

- Compliance with other laws and regulations
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost

To the extent possible, remedial alternatives that use permanent solutions and alternative treatment technologies will be considered.

### 5.3 RECOMMENDED FINAL CORRECTIVE MEASURE ALTERNATIVE

For each alternative that warrants further investigation, detailed documentation will be included to evaluate compliance with each of the objectives listed below.

- Overall protection of human health and the environment
- Compliance with media cleanup standards
- Control of the source of release
- Compliance with any applicable standards for management of wastes
- Long-term reliability and effectiveness
- Reduction in mobility, toxicity, or volume of wastes
- Short-term effectiveness
- Implementability
- Cost

To the extent possible, remedial alternatives that use permanent solutions and alternative treatment technologies will be considered. A list of potential remedial alternatives and data needs required to execute them is presented in Table 5.3.

### 5.3.1 Overall Protection of Human Health and the Environment

Alternatives must adequately protect human health and the environment from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site by eliminating, reducing, or controlling exposures to contamination. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with applicable laws, regulations, and guidance.

### 5.3.2 Compliance with Media Cleanup Standards

Alternatives will be assessed to determine whether they will reduce contaminant concentrations to levels below media-specific cleanup standards as derived using 30 TAC 335 Risk Reduction Standards. Alternatives will also be assessed as to whether they meet ARARs, or other federal and state environmental and public health laws and guidance. ARARs for this project were discussed in Section 3.0 of this WP.

### 5.3.3 Control the Source of Release

The source of the contamination at each of the SWMUs and AOCs will be confirmed during the RFI process. Remedial alternatives to control future releases from these sources will be evaluated and included in the selected remedial alternative.

### 5.3.4 Compliance with Applicable Standards for Management of Wastes

A discussion will be included in the CMS pertaining to implementation of waste management activities associated with remedial alternatives. Factors that may affect the waste management activities include evaluating the effect that closure regulations and land disposal restrictions could have on the selected remedial alternative.

### 5.3.5 Long-term Reliability and Effectiveness

Alternatives will be assessed for long-term effectiveness, permanence, and degree of remedial success. Each technology will be evaluated for potential deterioration over time and the impact this may have on receptors.

### 5.3.6 Reduction in Mobility, Toxicity, or Volume of Wastes

The degree to which the corrective measure alternatives employ treatments that reduces toxicity, mobility, or volume will be evaluated. The evaluation will focus on the following specific factors for each potential corrective measures alternative:

- The treatment process and the materials it will treat
- The amount of hazardous materials that will be destroyed or treated

- The degree to which the treatment will be irreversible
- The type and quantity of treatment residuals that will remain following treatment
- The degree to which the alternative will satisfy the statutory preference for treatment as a principal element

### **5.3.7** Short-term Effectiveness

The effectiveness of the alternatives will be evaluated to determine their impact on human health and the environment during the period in which the remedial alternative is being constructed and implemented and until the cleanup criteria are met. Factors to be addressed in evaluation of short term effectiveness include:

- Protection of human health and the environment during the remedial action, including such factors as exposure to dust during construction and potential exposure during transportation
- Protection of workers during the remedial alternative implementation
- Evaluation of the impact caused to the environment from the implementation of the remedial action
- Time required to reach the remedial alternative objectives

### 5.3.8 Cost

For each alternative, the cost will be estimated within a range of generally -30 percent to + 50 percent. The cost analysis will include separate derivations developed for capital costs, operation and maintenance (O&M) costs, 5-year review costs, net present value of capital and O&M costs, and potential future remedial actions.

Tables

### Table 5.1 Technology Types and Process Options for Soil NAS Fort Worth JRB, Texas

General Response Action	Technology Type	Process Options	Description	Comments
No-Action	None	Not Applicable	No-Action	Required to be retained by National Contingency Plan (NCP)
Institutional Controls	Access Restrictions	Access Restrictions	Physical limitations to prevent access to land and groundwater	Potentially applicable; retained for further consideration
		Deed Restrictions	Limiting land and groundwater use by subsequent owners	Potentially applicable; retained for further consideration
Containment	Barriers	Grout Curtains	Tubes of grout surround the contaminated area	Not applicable; does not control exposure pathways
		Slurry Walls	Inject clay slurry in continuous trench around contamination	Not applicable; does not control exposure pathways
		Sheet Piling	Driving interlocking steel walls around contamination	Not applicable; does not control exposure pathways
	Capping	Asphalt, clay, concrete, synthetic	Install near- impermeable cover to prevent infiltration to prevent contaminant movement	Potentially applicable
Treatment	Physical	Vapor Extraction	Extracting VOCs from the soil by creating a vacuum	Potentially applicable to VOC contamination
	Chemical	Soil Mixing	Use augers to mix in stabilizing chemicals	Not applicable for organic contaminants
		Soil Washing	Removing contaminants by adding solvents, surfactants to soil	Potentially applicable
		Immobilization	Using cement grout to immobilize contaminated soil	Questionable for organics; requires extensive testing

### Table 5.1 (continued) Technology Types and Process Options for Soil NAS Fort Worth JRB, Texas

General Response Action	Technology Type	Process Options	Description	Comments
Treatment (cont.)	Thermal	Incineration	Destroys organic contaminants	Potentially applicable
	Thermal	Low Temperature Thermal Oxidation	Drives off organic contaminants	Potentially applicable
	Biological	Aerobic	Microorganisms metabolize organic contaminants	Not applicable; difficult to implement in heterogeneous sites such as landfills
		Anaerobic	Microorganisms metabolize organic contaminants	Not applicable; difficult to implement in heterogeneous sites such as landfills
Removal/Disposal	Excavation	Excavation	Removing contaminated soil from area	Potentially applicable for both organic and morganic contamination
	Disposal	On-site Disposal	Creating RCRA landfill and placing contaminated soil in the landfill, or placing non-RCRA soil and sediment at existing landfill	New RCRA landfill not allowed by USAF regulations; not applicable; disposal of non-RCRA soil at existing site may be applicable
		Off-site Disposal	Sending waste to RCRA approved landfill if it meets best demonstrated achievable technology (BDAT) regulations	Potentially applicable

Table 5.2
Technology Types and Process Options for Groundwater
NAS Fort Worth JRB, Texas

General Response Action	Technology Type	Process Options	Description	Preliminary Screening Comments
No Action	None	Not applicable	No actions to remove contamination or sever the exposure pathway	Required for consideration by the NCP as a baseline comparison
Institutional Controls	Access Restrictions	Access restrictions	Physical limitations to prevent access to land and groundwater	Potentially applicable; retained for further consideration
		Deed restrictions	Limiting land and groundwater use by subsequent owners	Potentially applicable; retained for further consideration
	Monitoring	Monitoring	Water monitoring using existing wells	Potentially applicable; retained for further consideration
Containment	Physical Containment · Barriers	Sheet piling	Driving interlocking steel walls around contamination	Subject to corrosion; difficult to install with fill; cobbles in soil; not applicable
		Slurry walls	Inject clay slurry in continuous trench around contamination	Potentially applicable; retained for further consideration
	Capping	asphalt, clay, concrete, synthetic	Install impermeable cover to prevent infiltration and contaminant movement	Potentially applicable; retained for further consideration
Collection/ Treatment/Disposal	Collection Technologies:	Vertical wells	Pump contaminated groundwater using vertical wells to remove contaminants from the aquifer	Potentially applicable to the uppermost groundwater
		Horizontal wells	Pump contaminated groundwater using horizontal wells to remove contaminants from the aquifer	Potentially applicable to the uppermost groundwater

### Table 5.2 (continued) Technology Types and Process Options for Groundwater NAS Fort Worth JRB, Texas

General Response Action	Technology Type	Process Options	Description	Preliminary Screening Comments
Collection/ Treatment/Disposal (cont.)	Groundwater extraction	Interceptor trench	Intercept dissolved contaminants in the subsurface	Potentially applicable to the uppermost groundwater
	Treatment technologies: Physical treatment	Air stripping	Remove dissolved volatile organics from groundwater with air	Potentially applicable to the uppermost groundwater
		Carbon adsorption	Adsorb dissolved organic compounds onto granulated carbon	Potentially applicable to the uppermost groundwater
		Oil/water separation	Separate emulsified, floating or sinking oils from water	Potentially applicable to the uppermost groundwater
	Chemical Treatment	UV/oxidation	Use ultraviolet light with ozone or hydrogen peroxide to destroy contaminants	Potentially applicable to the uppermost groundwater
		Fenton-like chemistry	Use Fenton-like chemistry to generate hydroxyl radicals to cleave organic bonds	New technology; potentially applicable to the uppermost groundwater
	Biological treatment	Ex-situ bioremediation	Use microorganisms to destroy or alter contaminants	Not reliable for chlormated compounds; not considered
		In-situ bioremediation	Use microorganisms to destroy or alter contaminants	Not considered because still in the development stage for chlorinated hydrocarbons
		In-situ phytoremediation	Use plants to destroy or alter contaminants	Potentially applicable for alluvial terrace groundwater

### Table 5.2 (continued) Technology Types and Process Options for Groundwater NAS Fort Worth JRB, Texas

General Response Action	Technology Type	Process Options	Description	Preliminary Screening Comments
Collection/ Treatment/Disposal (cont.)	In-situ treatment	Air sparging	Pump air into aquifer, volatilize dissolved organics	Difficult to control in heterogeneous media; could spread contamination; not considered
	Discharge technologies: On-site discharge	Discharge to surface water	Discharge treated water to local surface water	Potentially applicable for the uppermost groundwater
	Off-site discharge	POTW	Send water to an off-site treatment facility	Potentially acceptable

Table 5.3
Corrective Measures Alternatives and Data Needs
NAS Fort Worth JRB, Texas

Matrix	General Response Action	Remedial Alternative	Data Needs
	No Action	Not Applicable	<ul><li>type and level of contamination</li><li>level of groundwater</li></ul>
Soil	Containment	Capping	
		Vapor Extraction	future land use     extent of
	Treatment	Soil Washing	contamination
		Incineration	
		Excavation	
	Removal/Disposal	Off-site Disposal	
	No Action	Not Applicable	type and level of contaminant     level of groundwater     future land use
Groundwater	Institutional Controls	Monitoring	
	Air Stripping	<ul> <li>yield of aquifer</li> </ul>	
		Carbon Adsorption  Collection, Treatment, and Disposal  Carbon Adsorption  Oil/Water Separation  UIV/oxidation  • location of contaminant • groundwater f direction • seasonal varia • extent of	contaminant
	Treatment, and		<ul> <li>groundwater flow direction</li> <li>seasonal variation</li> </ul>
	2.5505		extent of contamination
	1000	POTW (on-/off-site)	

Sources: CH2M HILL, 1996b.

CAFB Management Action Plan, October 1993.

RCRA Facility Investigation Statement of Work, January 1997.

Section 6

### 6.0 DATA ASSESSMENT, RECORDS, AND REPORTING REQUIREMENTS

The following sections provide an explanation for procedures that are used in the verification and maintenance of data, and how data will be reported throughout the course of the investigation.

### 6.1 DATA ASSESSMENT

The project chemist will review all data received from the laboratory. This review consists of the following:

- Sample Analysis Completeness Were all samples analyzed? Were samples analyzed for the parameters listed in the work plans?
- Evaluation of Holding Times Were samples analyzed within the specified holding and extraction times?
- Evaluation of Quality Control Were standard curves within method control limits? Were preparation and method blanks contaminated? Were continuing calibration standards in control? Were matrix spikes (MSs) and matrix spike duplicates (MSDs) performed? How did field duplicates compare? Were corrective actions taken?
- Establishment of Detection Limits Were detection limits met? If not, why?

The project chemist utilizes "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analysis" (EPA, 1988) and "National Functional Guidelines for Organic Data Review" (EPA, 1991c) as guidance documents for data validation.

In general, for the gas chromatograph (GC), an initial 5-point calibration must exhibit a response factor (RF) of less than 20 percent relative standard deviation (RSD) or a calibration curve with a correlation coefficient of greater than 0.995, and the continuing calibration check standard should not vary over 15 percent of the initial calibration. Retention time windows must be established for each specific GC column initially, followed by daily retention time windows. Quality control check standards must be analyzed for every analytical batch, method blanks for every analytical batch, and a MS and MSD pair for every 20 samples. Surrogates must be added to all standards, blanks, and samples.

If any data points are qualified, they will receive the data qualifiers described on Table 8.2-1 of the Base-Wide Quality Assurance Project Plan (QAPP) (HydroGeoLogic, 1998b). The data associated with compounds/analytes that exhibit either poor response, poor percent difference, or relative percent difference in the initial calibration or continuing calibration standards, or poor recoveries in the laboratory control sample (LCS) are considered quantitative estimates and are flagged (J, UJ, or R) accordingly. If the internal standard (IS) or surrogate fails criteria (after corrective action was taken), compounds associated with the IS or surrogates would be flagged (J, UJ, or R) as estimated. If sample analysis exceeded holding times, the data would be flagged as

estimated (J, UJ, or R). If the method blank was contaminated with common laboratory chemicals or field contamination, any result less than or equal to 10 times that found in the blank would be flagged as estimated (U) (for common organics, less than or equal to 5 times for uncommon organics and for any inorganics). When data exhibit several deficiencies resulting in poor quality assurance (QA) and QC support, then the data is rejected, considered unusable, and flagged with an "R." Any MS/MSD data would be reviewed separately and qualified based on all the data available. Estimated data is not necessarily unusable data. All project-wide precision, accuracy, and completeness goals will be reviewed, and the data will be validated according to these goals. If these goals are not met, resampling and analysis may be necessary.

The project chemist also reviews the field and office sampling records made during sample collection along with the results from the field QC samples. This review consists of the following:

- Field Record Completeness: Were all field analyses performed as planned? Were all field samples collected as directed in the work plans? Were any problems encountered and how were they resolved? Were all field records complete?
- Sampling and Decontamination Procedures Review: Were all field duplicates collected? How did they compare? Were all rinsates collected? Did these rinsates show contamination? Were the trip blanks contaminated? Did samples arrive intact and in proper shipping protocol?
- Identification of Valid Samples: Were samples collected using the proper protocol? Were there probable sources of potential contamination during sampling?
- Correlation of Field Test Data and Identification of Anomalous Field Test Data: Did different methods of measurement for the same test correlate?

Review of the results of the field QC data such as rinsates, trip blanks, and duplicates can help in assessing sample integrity. The field data and laboratory data will be reviewed and evaluated to the established data quality objectives. Data quality evaluations will be performed on all NAS Fort Worth JRB samples (100 percent). However, formal data validation will only be conducted on 10 percent of the samples collected from each media of concern during this investigation.

### 6.2 RECORD KEEPING

Records of field and laboratory activities will be documented on standard forms (Appendix D) as noted in the accompanying FSP. Project data such as geophysical surveys, groundwater level measurements, boring logs, survey data, well construction forms, chain-of-custody forms, and equipment calibration logs will be reviewed for accuracy and completeness. These documents will be reviewed by the Project Manager daily and retained in the project files.

### 6.3 REPORTING REQUIREMENTS

### 6.3.1 RCRA Facility Investigation

The primary report of the project will be the RFI based on the investigation and reporting requirements of the NAS Fort Worth JRB HW-50289 permit. Four copies of the Final Soils and Groundwater report will be submitted along with the RFI report as required by Provision VIII.D of the HW-50289 permit once each of the subject sites have been fully characterized.

The report will characterize the environmental conditions at each site, check each sample package for completeness and quality, evaluate data from each site, and recommend a future course of action for each site. Each site potentially has one of two recommended future courses: no or limited action, or advancement to a CMS.

If the SWMU cannot attain closure under RRS1 or RRS2, then a CMS will be required. Sites continuing to the CMS will be screened for potential remedial alternatives. One alternative will be selected and proposed as the remedial action to be conducted at the site.

### **6.3.2** Corrective Measures Study

The purpose of the CMS is to develop and evaluate potential remedial alternatives and to propose the appropriate corrective measure. An evaluation of the risk to human health and the environment will be evaluated in the CMS based on the results of the RFI. The corrective action that best reduces the risks to human health and the environment to acceptable levels will be proposed.

### 6.3.3 Corrective Measures Implementation Plan

A Corrective Measures Implementation Plan (CMI) will be submitted for sites where the RFI results indicate that remediation is warranted. The CMI work plan details the specific activities that will be undertaken to implement the remedial action. The remedial action alternative selected for an individual site will be based on the alternatives presented in the CMS. The recommendation presented will include preliminary designs, site specific drawings, cost estimates, and schedules for the remedial action. The CMI work plan may be submitted along with the CMS, or the CMS and CMI may be submitted separately.

### **6.3.4 Decision Documents**

If a release of hazardous constituents was not identified at a SWMU or AOC, or if the nature and extent of contamination has been defined and the site has attained closure/remediated to RRS1 or RRS2 levels, then the RFI report shall also serve the purpose of a Final Closure Report (i.e., NFA decision document). A deed certification (as the CMI) and public notice of the remedy decision is still under an RRS2 closure.

Section 7

### 7.0 PROJECT SCHEDULE

The activities described in this WP will be implemented in accordance with the schedule provided in Figure 7.1. The starting date for the field effort will be the date of agency concurrence of the relevant portions of the WP. If possible, this schedule will be accelerated with select activities (e.g., procurement of materials and supplies) occurring when resolution of significant technical issues is made between NAS Fort Worth JRB and regulatory agencies.

Figures

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## TAB

Section 8

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## TAB

Field Sampling Plan

# FINAL FIELD SAMPLING PLAN RCRA FACILITY INVESTIGATION OF SWMUS 19, 20, 21, AND 53; AND SITE INVESTIGATION OF AOCS 17, 18, AND 19 AT NAS FORT WORTH JRB, TEXAS



Prepared for

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#### LIST OF ACRONYMS AND ABBREVIATIONS

3-D three-dimensional

AFCEE U.S. Air Force Center for Environmental Excellence

AOC area of concern

AST aboveground storage tank

ASTM American Society for Testing and Materials

bgs below ground surface

BRAC Base Realignment and Closure

°C degrees Celsius

CAFB Carswell Air Force Base CFR Code of Federal Regulations

COC chain-of-custody

DNAPL dense non-aqueous phase liquids

DO dissolved oxygen
DPT direct push technology

EC electrical conductivity
EM electromagnetic induction

EPA U.S. Environmental Protection Agency

Fe iron

FSP Field Sampling Plan FTA-2 Fire Training Area No. 2

HSA hollow stem auger

HSO Health and Safety Officer HSP Health and Safety Plan

HW hazardous waste HydroGeoLogic HydroGeoLogic, Inc.

IDW investigative derived waste IRP Installation Restoration Program

IRPIMS Installation Restoration Program Information Management System

JP-4 jet propulsion (grade 4) fuel

JRB Joint Reserve Base

#### LIST OF ACRONYMS AND ABBREVIATIONS

L/min	liter per minute
LNAPL	light non-aqueous phase liquid
MS	matrix spike
mS/m	millisiemens per meter
MSD	matrix spike duplicate
NARA	National Archives and Records Administration
NAS	Naval Air Station
NGVD	National Geodetic Vertical Datum
NTU	nephelometric turbidity unit
nT/m	nanotelsas per meter
ORP	oxidation-reduction potential
OVA	organic vapor analyzer
OWS	oil/water separator
DCD	and the Season D. Arman
PCB	polychlorinated biphenyl
PID	photoionization detector
PM	Project Manager
POC	point-of-contact
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QAII	Quality Assurance Froject Fran
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RRS	Risk Reduction Standards
SAP	Sampling and Analysis Plan
SC	specific conductivity
SI	Site Investigation
SVOC	semi volatile organic compound

TAC Texas Administrative Code

TNRCC Texas Natural Resource Conservation Commission

solid waste management unit

TOC total organic carbon

UN United Nations

**SWMU** 

USAF United States Air Force

USCS United Soil Classification System

#### LIST OF ACRONYMS AND ABBREVIATIONS

USGS UST	U. S. Geological Survey underground storage tank
VOC	volatile organic compound
WAA WP	waste accumulation area Work Plan

## FINAL FIELD SAMPLING PLAN RCRA FACILITY INVESTIGATION OF SWMUS 19, 20, 21, AND 53; AND SITE INVESTIGATION OF AOCS 17, 18, AND 19 AT NAS FORT WORTH JRB, TEXAS

#### 1.0 INTRODUCTION

The Field Sampling Plan (FSP) presents the requirements and procedures for conducting field operations and investigations. This project specific FSP has been prepared to ensure that (1) the data quality objectives specified for this project are met, (2) the field sampling protocols are documented and reviewed in a consistent manner, and (3) the data collected are scientifically valid and defensible. This site specific FSP and the Basewide Quality Assurance Project Plan (QAPP) (HydroGeoLogic Inc. [HydroGeoLogic], 1998), shall constitute, by definition, the Sampling and Analysis Plan (SAP).

Guidelines followed in the preparation of this plan are set out in the Naval Air Station (NAS) Fort Worth Resource Conservation and Recovery Act (RCRA) Hazardous Waste (HW) permit number HW-50289 issued by the Texas Natural Resource Conservation Committee (TNRCC) on February 7, 1991. Additional reference documents followed in the preparation of this FSP include the U.S. Air Force Center for Environmental Excellence (AFCEE) "AFCEE's Model Field Sampling Plan" (AFCEE, 1996) and the "Handbook for the Installation Restoration Program (IRP) for Remedial Investigations and Feasibility Studies" (AFCEE, 1993).

This FSP is required reading for all staff participating in the work effort. The FSP shall be in the possession of the field teams during sample collection. HydroGeoLogic and its subcontractors shall be required to comply with the procedures documented in this FSP in order to maintain comparability and representativeness of the collected and generated data.

Controlled distribution of the Final FSP shall be implemented by HydroGeoLogic to ensure that the current approved version is being used. A sequential numbering system shall be used to identify controlled copies of the Final FSP. Controlled copies shall be provided to applicable United States Air Force (USAF) managers, regulatory agencies, remedial project managers (PMs), and quality assurance (QA) coordinators. Whenever USAF revisions are made or addenda added to the FSP, a document control system shall be put into place to ensure that (1) all parties holding a controlled copy of the FSP shall receive the revisions/addenda, and (2) outdated material is removed from circulation. The document control system does not preclude making and using copies of the FSP; however, the holders of controlled copies are responsible for distributing additional material to update any copies within their organizations. The distribution list for controlled copies shall be maintained by HydroGeoLogic.

#### 2.0 PROJECT BACKGROUND

The following sections briefly describe the project objectives and present site descripitions for this work plan (WP).

#### 2.1 SITE HISTORY

Carswell Air Force Base (CAFB) was officially closed on September 30, 1993. A parcel of the former CAFB, NAS Fort Worth Joint Reserve Base (JRB), is in the process of being transferred from Air Force to Navy management. Before the property transfer can be completed, required environmental investigations of potential contamination related to USAF activities at the NAS Fort Worth property are to be completed and contaminated sites are to be remediated.

This investigation will be managed by the USAF under the Environmental Restoration Account. Other portions of the former CAFB that are not being transferred to the Navy remain under Base Realignment and Closure (BRAC) funding and management.

#### 2.2 PROJECT OBJECTIVES

The overall objective of this project, and purpose of the field investigations, is to gather sufficient data to obtain closure of four solid waste management units (SWMUs) and three areas of concern (AOCs) under the TNRCC Risk Reduction Standards (RRS) program. An overview of the RRS program is presented in Section 4.1 of the WP. In addition, the SWMUs and AOCs at NAS Fort Worth JRB are subject to the specific requirements of the TNRCC Permit HW-50289. Specific permit requirements are discussed in greater detail in Section 3.2 of the WP.

In order to obtain closure of the subject SWMUs and AOCs, an investigation will be conducted at each site in order to determine if hazardous constituents have been released into the environment. The four primary objectives for this project are as follows:

- Fill data gaps with respect to the hydrogeological regime at several of the sites.
- Determine if subsurface anomalies exist in select areas using geophysical survey methods.
- Determine if a release from the units has occurred.
- If contamination is encountered, characterize the nature and extent of the contamination.

These objectives are discussed in greater detail in Section 3.4 of the WP. When delineation of the contamination is complete at each of the SWMUs and AOCs, the data will be compiled and presented in a RCRA Facility Investigation (RFI)/Site Investigation (SI) Report with a discussion of the RRS standard that is appropriate for closure at each of the sites.

Field studies that will be used to characterize these sites include the following:

- Continuous soil borings from the ground surface to the top of the water table. Samples will be collected at 5-foot intervals with surface samples starting from 0 to 2 feet below ground surface (bgs) and subsurface samples starting at 5 to 7 feet bgs to determine the presence or absence of soil contamination at each location.
- Monitoring well installation and/or sampling. At sites where soil contamination is found, a minimum of one downgradient soil boring will be advanced to the top of the water table and further sampled every five feet for hydrogeologic characterization until bedrock is encountered. The boring will be completed as a monitoring well for groundwater sampling beneath the site. Where available, previous groundwater elevation data will be used to characterize aquifer conditions beneath the areas of interest.
- Geophysical investigations will be conducted using electromagnetic induction (EM)
  and metal detection methods. Data will be collected to determine the existence
  and/or extent of subsurface anomalies.

#### 2.3 PROJECT SITE DESCRIPTION

NAS Fort Worth JRB is located on 2,555 acres of land in Tarrant County, Texas, 8 miles west of downtown Fort Worth. The sites covered by this FSP and SI are four SWMUs and three AOCs located throughout NAS Fort Worth JRB. These SWMUs and AOCs are identified as follows:

- SWMU 19 (Fire Training Area No. 2)
- SWMU 20 (Waste Fuel Storage Tank)
- SWMU 21 (Waste Oil Tank)
- SWMU 53 (Storm Water Drainage System)
- AOC 17 (Suspected Former Landfill)
- AOC 18 (Suspected Former Fire Training Area A)
- AOC 19 (Suspected Former Fire Training Area B)

The locations of the SWMUs and AOCs in relation to the Base are presented on Figure 2.1.

#### **2.3.1** Description of SWMUs 19, 20, and 21

SWMU 19, the Fire Training Area No. 2 (FTA-2), SWMU 20, the Waste Fuel Storage Tank, and SWMU 21, the Waste Oil Tank, were located between the north-south taxiway and the former radar facility at Landfill No. 4. As these sites are related, they will be addressed as a single unit for the purposes of this investigation.

SWMU 19 was used as a fire training area from 1963 until approximately 1993 by the base fire department to simulate aircraft fires for training exercises. SWMU 19 consisted of a circular, gravel-lined pit with inner and outer earthen berms made of clayey soil around its perimeter (A.T.

Kearney, 1989). The outer berm measured approximately 2 feet high, 260 feet in diameter, and encompassed an area measuring approximately 1.2 acres. A drainage pipe was located on the northeast side of the outer bermed area. Drainage from this pipe was controlled by a manual valve. The inner berm measured approximately 2 feet high, 120 feet in diameter, and encompassed a total area of approximately 0.25 acre (Dames & Moore, 1995). The area within the inner berm contained a gravel pit where 25-30 steel dumpsters were arranged in the shape of an aircraft. Periodically, the dumpsters were filled with oil and fuel wastes fed from two storage tanks (SWMUs 20 and 21) and ignited during fire training exercises to simulate an aircraft fire (Law Environmental Inc. [Law], 1996). In addition to the two bermed areas, a pit was reported to have existed at SWMU 19 which collected runoff from the bermed areas. This pit was eventually filled with sediment over time. The location and the time the pit existed is unknown (Radian, 1989).

SWMU 20 was an 8,500-gallon concrete above ground storage tank (AST) located approximately 50 feet from the southwest side of SWMU 19 and approximately 400 feet from a tributary of Farmers Branch Creek. SWMU 20 stored flammable liquid wastes including grade 4 jet propulsion fuel (JP-4), waste oils, kerosene and possibly solvents for use during fire training exercises. The liquid wastes were delivered from SWMU 20 to the dumpsters located within the inner bermed area of SWMU 19 by an aboveground pump and pipe system (A.T. Kearney, 1989). The dumpsters, AST and associated piping were removed from the site in 1993 (Dames & Moore, 1995).

SWMU 21 consisted of a 12,000-gallon¹ underground storage tank (UST) that was used to store waste oils and solvents from the flightline industrial shops, for eventual use at the inner bermed area of SWMU 19 during training exercises. SWMU 21 was reported to have been installed in 1963 and removed prior to 1993. According to a Liquid Fuel Systems map from 1986, SWMU 21 is located approximately 50 ft from the western side of SWMU 19 and 300 ft from a tributary of Farmers Branch (Department of the Air Force, 1986). Although SWMU 21 was reported to have been removed, no documentation is available (Dames & Moore, 1995).

SWMUs 19 and 20 were removed from service in 1993. During the removal effort the top three feet of soil was excavated from the bermed area of FTA-2, and was bioremediated in a biocell. A compacted clay liner was then placed in the bottom of the excavation and the bioremediated soil was returned to the surface. The filled area was contoured to facilitate runoff of rainwater, and the site was seeded with grass to prevent erosion (Dames & Moore, 1995). A summary of the remedial effort at SWMUs 19 and 20 is presented in Section 3.5.1.1.5 of the WP.

#### 2.3.2 Description of SWMU 53

SWMU 53, the Storm Water Drainage System, begins east of Haile Drive on the north side of the Building 1190 oil/water separator (OWS) (SWMU 52), and continues to the southeast through the POL Tank Farm (SWMU 68), to where it eventually ends at the intersection of Hercules and Desert Storm Roads. SWMU 53 formerly consisted of an unlined ditch from its point of origin

<sup>&</sup>lt;sup>1</sup> The UST was described as a 9,500-gallon tank in A.T. Kearney's 1989 Facility Investigation.

to the point where it intersected the POL Tank Farm. At the POL Tank Farm SWMU 53 became a concrete-lined channel (CH2M Hill, 1984).

SWMU 53 currently receives waste water discharge from the Building 1190 OWS (SWMU 52). Discharge from SWMU 52 includes waste water from Hangar 1048 which houses the fuel systems shop. Discharges from the fuel systems shop consists of waste JP-4. SWMU 53 also receives storm water runoff from the flightline and hangar areas, and the POL tank farm (SWMU 68). Storm water runoff from these areas may include traces of fuels, oils, pesticides, and solvents used on base (A.T. Kearney, 1989).

Historically, discharges to SWMU 53 included washrack wastes from SWMUs 49 and 50 (former Aircraft Wash Area No. 1 and No. 2) which contained traces of fuels, oils, solvents, and soaps. From approximately 1979 to 1984, the pipe leading from the fuel systems shop to the Building 1190 OWS was ruptured, allowing JP-4 and washrack wastes to flow directly into SWMU 53 (CH2M Hill, 1984). SMWU 53 also received storm water runoff from the Building 1190 storage shed (AOC 15), and the central waste storage area (SWMU 51)<sup>2</sup>. Waste stored at AOC 15 included PD-680 and xylene. Waste stored at SWMU 51 included unspecified quantities of various wastes produced from all industrial activities conducted throughout the base. Both AOC 15 and SWMU 51 no longer serve as waste accumulation areas (WAAs).

SWMU 53 is suspected to have existed since maintenance operations began at the facility in 1942. In 1993, approximately 700 cubic yards of soil was removed from the culvert, and a concrete liner was installed along the entire length of the SWMU (CH2M Hill, 1996). SWMU 53 is currently operational.

#### 2.3.3 Description of AOC 17

AOC 17 is a suspected former landfill that extends from the west side of Building 1840, along the southwest side of Building 1820, to where it eventually ends north of Building 1803. This site was identified on aerial photographs of NAS Fort Worth JRB during the period of April 10, 1942 until April 4, 1944 (National Archives and Records Administration [NARA], 1942, 1944). During the time of operation, AOC 17 was located just west of the most western section of the West Fork Trinity River (prior to rerouting the river). Currently, the surface of AOC 17 is covered partially by grass and partially by the parking lot along the southwest side of Building 1820.

The operational history of AOC 17 is unknown. However, if a landfill operated at the site during the early 1940s, it may have received construction debris, waste paints contaminated with thinners and solvents, waste oils, and PD-680 as discussed in Section 1.2.3.2 of the WP.

<sup>&</sup>lt;sup>2</sup> AOC 13 and SWMU 51 are currently being investigated in accordance with the Revised Final Work Plans, RCRA Facility Investigation of Waste Accumulation Areas (WAAs), HydroGeoLogic, 1999.

#### 2.3.4 Description of AOC 18

AOC 17 (Suspected Former Fire Training Area A) is located east of Building 1101, just north of Phillips Circle and south of Hobby Shop Road. This site was identified on aerial photographs of NAS Fort Worth JRB during the period of December 31, 1950 through January 4, 1953 (NARA, 1950, 1953).

The operational history of AOC 18 is unknown. However, as the site was suspected to have been operated as a fire training area during the 1950's and early 1960's, wastes received may have consisted of various waste oils, recovered fuels, and spent solvents and cleaners as discussed in Section 1.2.3.2 of the WP.

Currently, the location of AOC 18 is covered partially by Building 1067 and a variety of sheds, partially by an asphalt parking lot, and partially by grass. According to Chief Pheiffer of the U.S. Navy, the site is currently used as a parking lot for transient aircraft refueling trucks. Trucks containing jet fuel, gasoline, and diesel fuels are parked onsite. The parking area slopes towards a bermed containment area to the east. No spills have been recorded to date.

#### 2.3.5 Description of AOC 19

AOC 19 (Suspected Former Fire Training Area B) is located south of taxiway Charlie, west of Landfill No. 8 (SWMU 25), and north of Farmers Branch Creek. This site was identified on aerial photographs of NAS Fort Worth JRB during the period of February 3, 1954 through August 22, 1962 (U.S. Geological Survey [USGS], 1954; NARA, 1962). Currently, the location of AOC 19 is covered by grass.

The operational history of AOC 19 is unknown. However, as the site was suspected to have operated as a fire training area during the 1950's and early 1960's, wastes received may have consisted of various waste oils, recovered fuels, and spent solvents and cleaners as discussed in Section 1.2.3.2 of the WP.

#### 2.4 PROJECT SITE CONTAMINATION HISTORY

Section 3.0 of the WP provides the history of environmental investigations conducted at each site and documents contamination discovered at each site. Please refer to this section for the investigative history of the sites.

#### 3.0 PROJECT SCOPE AND DATA QUALITY OBJECTIVES

The following sections describe the objectives of the RFI/SI and the specific field activities that will be conducted during the investigations.

#### 3.1 DATA QUALITY OBJECTIVES

The data generated by this project must be of sufficient quality and quantity to support the overall project objective: the closure of four SWMUs and three AOCs located at NAS Fort Worth JRB under the TNRCC Risk Reduction Program. The objectives and focus of this work will be to characterize the nature and extent of any contamination detected.

Data from the following categories are required for this study:

Site Characterization - Data will be used to evaluate physical and chemical properties of soil and groundwater. The data will also be used to characterize the nature and extent of any contaminants detected.

Health and Safety - Data will be used to establish the level of protection needed for the work party and other site-related personnel. This data will be gathered during intrusive activities by the use of organic vapor monitors, Draeger tubes, and the explosimeter.

Site characterization data will be a combination of screening data and definitive data. Health and safety data will be collected as screening data. The definitions of screening data and definitive data, as established by the "Data Quality Objectives Process for Superfund Interim Final Guidance" (U.S. Environmental Protection Agency (EPA)/540/G-93/071, 1993), are described below:

- Screening Data with Definitive Confirmation Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, instead of elaborate extraction/digestion and cleanup. Screening data provides analyte identification and quantification. Although the quantification may be determined using analytical methods with QA/quality control (QC) procedures and criteria associated with definitive data, screening data without associated confirmation data are not considered to be data of known quality.
- <u>Definitive Data</u> Definitive data will be generated using rigorous analytical methods, such as approved EPA reference methods. Data will be analyte-specific, with confirmation of analyte identity and concentration. These methods produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined.

The data generated by the laboratory analysis of samples must be sufficiently sensitive to allow comparison of the results to the TNRCC RRS. The Basewide QAPP (HydroGeoLogic, 1998) describes each method that will be performed as part of the investigation and outlines the quality assurance measures the contract laboratory must follow. The methods of analysis selected for samples collected from NAS Fort Worth JRB will produce screening as well as definitive data. Table 3.1 is a summary of the data quality levels and intended use for data collected during the RFI/SI.

#### 3.2 SAMPLE ANALYSIS SUMMARY

Provision VIII of Permit HW-50289 requires that soil and groundwater samples submitted for chemical analysis be analyzed in accordance with EPA SW-846 for all Appendix IX constituents, unless a shorter list can be justified. Table 3.2 provides a summary of the materials handled or potentially handled at each of the subject sites.

#### 3.3 FIELD ACTIVITIES

The following sections describe the proposed field investigation activities for each site to be investigated during this study. More detailed descriptions of the rationale and justification for each of the proposed activities are presented in Section 3.0 of the WP.

The proposed field tasks described in this FSP will be conducted to achieve the project objectives as presented in Section 2.2. Field investigative activities will be conducted at four SWMUs and three AOCs. Table 3.3 provides a summary of the field activities at each site, and Tables 3.4 and 3.5 present the number of soil and groundwater samples to be collected and the analytical methods to be performed during the field investigation.

#### 3.3.1 SWMUs 19, 20, and 21

Proposed investigation activities at SWMUs 19, 20, and 21 include a metal detection survey, soil boring installations, soil sampling, monitoring well installations, and groundwater sampling from new and existing monitoring wells. A summary of proposed field activities is presented in Table 3.3.

Before any intrusive activities occur at the site, a metal detection survey will be performed in order to confirm the presence or absence of SWMU 21, the 12,000-gallon UST. This survey will be performed using a Geonics EM61 system. A detailed explanation of geophysical methods is presented in Section 5.2.2.1.

The metal detection survey will be conducted in and around the documented location of SWMU 21 (Department of the Air Force, 1986). The proposed survey grid is depicted on Figure 3.1. If anomalies associated with a UST are identified at the site, then the UST will be removed. All removal efforts will be proposed and reported under a separate investigation. If the existence of SWMU 21 is not confirmed, the removal of the UST will be assumed as previously reported, and the soil and groundwater investigation will be performed for the fire training area as follows.



A total of 18 soil borings will be advanced in the areas within and surrounding SWMUs 19, 20, and 21, as illustrated on Figure 3.1. The locations of these borings have been placed to confirm the presence of contamination detected in previous investigations, as well as to fully characterize the entire fire training area. All borings will be advanced to the top of the water table using direct push technology (DPT), and soil samples will be collected in 5-foot intervals from the ground surface to the water table.

The analytical results of these samples are intended to characterize the bioremediated surface soils, and delineate the linear and vertical extent of subsurface soil contamination detected during previous investigations. Historic investigative activities are summarized in Section 3.0 of the WP. Based on the wastes handled at SWMUs 19, 20, and 21 during the time this site was operational, all soil samples will be analyzed for the following reduced list of Appendix IX analyses:

#### Appendix IX

• SW8260B - Volatile organic compounds (VOCs)

• SW8270C - Semivolatile organic compounds (SVOCs)

SW6010B - metals
 SW7471A - mercury

Soil analytical results are intended to determine and characterize the extent that the wastes handled at SWMUs 19, 20, and 21 that have been released to the environment. This will be accomplished by attempting to define the vertical and lateral extent of all analytical detections that exceed RRS1 levels.

After receiving analytical results from the soil investigation, a second mobilization will occur to install monitoring wells. Two of the proposed soil boring locations, one location in the northwest corner, and one location in the southeast corner of the site, will be selected for monitoring well locations. A hollow stem auger (HSA) will be used and samples will be logged continuously from the water table until bedrock is encountered. These borings will be completed as monitoring wells in order to more fully characterize the groundwater upgradient and downgradient of the site. The selected locations for monitoring well installation may change based on initial soil analytical results. Proposed monitoring well locations are depicted on Figure 3.1.

Groundwater samples will be collected at the two newly installed wells and at existing wells FT09-12A, FT09-12B and FT09-12C. Three rounds of bimonthly groundwater sampling will be conducted. Groundwater will be analyzed for a reduced list of Appendix IX analyses based on the results of the initial soil investigation.

A summary of proposed groundwater sampling and analysis is presented in Table 3.5. Additional soil borings and/or monitoring wells may be installed at a later date if necessary, in order to delineate the extent of any contamination not completely delineated during the initial investigation.

#### 3.3.2 SWMU 53

Proposed activities at SWMU 53 include the inspection of the concrete liner running the length of SWMU 53, the installation of 19 soil borings, the installation of one monitoring well, and the collection of soil and groundwater samples for laboratory analyses.

A total of 19 soil borings will be advanced in the area of SWMU 53 as illustrated in Figure 3.2. Soil borings will be placed approximately every 100 feet, with alternating upgradient and downgradient locations to confirm the presence of contamination detected in previous investigations, as well as to more fully characterize the entire drainage ditch. All 19 soil borings will be advanced to the top of the water table and soil samples will be collected in 5-foot intervals from the ground surface to the water table.

The analytical results of these samples are intended to characterize the soil contamination detected in preliminary SIs. A summary of the proposed soil sampling and analysis is presented in Table 3.4. If the concrete liner within SWMU 53 displays cracks, gaps, or deteriorated seams then additional soil borings will be advanced through these areas and soil samples collected from beneath the liner. Based on the wastes handled at SWMU 53, all soil samples will be analyzed for the following reduced list of Appendix IX analyses:

#### Appendix IX

•	SW8260B	-	VOCs
•	SW8270C	-	SVOCs
•	SW6010B	-	metals
•	SW7471A	-	mercury

Soil analytical results from SWMU 53 are intended to characterize the nature and extent of wastes released into the environment.

After receiving analytical results from the soil investigation, a second mobilization will occur to install monitoring wells. One soil boring on the southeast edge of SWMU 53 will be selected for a monitoring well location. Using an HSA, this location will be logged continuously from the water table until bedrock is encountered. Samples collected from this monitoring well will be used to more fully characterize groundwater downgradient of the site. The selected location for the monitoring well may change based on the initial soil analytical results. The proposed monitoring well location is depicted in Figure 3.2.

In addition to the soil investigation, a groundwater investigation will be performed at SWMU 53. Groundwater samples will be collected from five existing wells ST14-W08, ST14-W09, ST14-W12, 17I, and 17J; and from the newly installed monitoring well.

Three rounds of bimonthly groundwater sampling will be conducted. Groundwater samples will be analyzed for a reduced list of Appendix IX analyses based on the results of the initial soil

investigation. A summary of proposed groundwater sampling and analysis is presented in Table 3.5.

If necessary, additional soil borings and/or monitoring wells may be installed at a later date in order to further delineate any contamination encountered during the initial investigation.

#### 3.3.3 AOC 17

Proposed field activities include the following:

- conduct a geophysical survey to identify any potential conductivity anomalies which may indicate the presence of a former landfill,
- install soil borings for visual observation and chemical analysis,
- install temporary piezometers to determine groundwater flow direction,
- install monitoring wells, and
- collect and analyze soil and groundwater samples to determine the nature and extent of any contamination at AOC 17.

In order to confirm the presence or absence of a former landfill at AOC 17, a geophysical investigation will be conducted at the site. Two geophysical methods will be used during the investigation: an EM method and a magnetic method. These surveys will be conducted to evaluate the extent of the former landfill (if present) by identifying soil disturbances, and locating subsurface metallic objects, such as tanks, pipes, drums, etc.

A minimum of seven soil borings will be advanced at AOC 17 using a DPT. The exact location of the borings will be determined based on the results of the geophysical survey. Three borings will be advanced to the water table and four borings will be advanced to a depth of at least 10 feet below groundwater or to bedrock, for the purpose of installing piezometers. All soil samples will be collected at 5-foot intervals from the ground surface to the water table. The purpose of these borings will be to evaluate the extent of the landfill (if present) and to delineate the extent of possible contamination associated with AOC 17. Figure 3.3 illustrates proposed soil boring locations. Continuous cores will be used to evaluate the physical characteristics of the soil and/or waste. Soil samples will be collected at 5-foot intervals from the ground surface to the water table, and submitted for chemical analyses. As there is no historic chemical data at AOC 17, all soil samples will be analyzed for the following full Appendix IX suite.

#### Appendix IX

•	SW8260B	-	VOCs
•	SW8270C	-	SVOCs
•	SW8080A	-	organochlorine pesticides and polychlorinated biphenyls (PCBs)
•	SW8141A	-	organophosphorus pesticides
•	SW8151A	_	chlorinated herbicides
•	SW8280A	_	dioxins and furans

SW9012A - cyanideSW9030A - sulfide

• SW6010B - trace elements (metals)

SW7471A - mercury

Although groundwater flow at NAS Fort Worth JRB is generally from west to east across the base, localized variations in groundwater flow directions exist. There is one downgradient monitoring well near AOC 17 (GMI-22-05M). Little groundwater flow information is available for this area. Four soil borings will be converted into temporary piezometers, and used to evaluate the groundwater flow direction prior to the installation of any monitoring wells. Proposed piezometer locations are depicted on Figure 3.3.

If contamination is detected during the soil investigation, a second mobilization will occur to install monitoring wells. After groundwater flow patterns have been established, four 2-inch monitoring wells will be installed using a HSA. Each of these borings will be completed 1-foot into the bedrock in order to confirm bedrock. The monitoring well pattern will consist of one upgradient well and three downgradient wells.

Three rounds of bimonthly groundwater sampling will be conducted. Groundwater samples will be analyzed for a reduced list of Appendix IX analyses based on the results of the initial soil investigation. The proposed soil and groundwater analyses for the site are summarized in Tables 3.4 and 3.5, respectively. Additional soil borings and/or monitoring wells may be installed at a later date to further delineate the extent of any contamination found to be originating from AOC 17.

#### 3.3.4 AOC 18

Four soil borings will be advanced at AOC 18 using DPT. The purpose of these borings will be to identify and characterize contamination associated with AOC 18. Figure 3.4 illustrates the proposed soil boring locations. Continuous cores will be used to evaluate the physical characteristics of the soil. Soil samples will be collected at 5-foot intervals from the ground surface to the water table, and submitted for analysis. Soil samples will be analyzed for the following reduced list of Appendix IX analyses.

#### Appendix IX

SW8260B
 SW8270C
 SVOCs

• SW6010B - trace elements (metals)

• SW7471A - mercury

The proposed soil analyses for the site are summarized in Table 3.4.

Contamination has not been previously detected at this site. Therefore, a groundwater investigation will only be performed if the initial soil investigation indicates a release has

occurred. New monitoring wells will be installed using a HSA. Each will be completed 1-foot into the bedrock in order to confirm bedrock. The monitoring well pattern will consist of one upgradient well and three downgradient wells. The wells will then be sampled and groundwater analyzed based on results of the soil investigation. Three rounds of groundwater sampling will be conducted at approximately 2-month intervals. Analytical data will be used to assess if contaminants at AOC 18 have impacted the groundwater.

Additional soil borings and/or monitoring wells may be installed at a later date to delineate the extent of any contamination found to be originating from AOC 18.

#### 3.3.5 AOC 19

Four soil borings will be advanced at AOC 19 using DPT. The purpose of these borings will be to identify and characterize contamination associated with AOC 19. Figure 3.5 illustrates the proposed soil boring locations. Continuous cores will be used to evaluate the physical characteristics of the soil (or landfill waste, if it is encountered). Soil samples will be collected at 5-foot intervals from the ground surface to the water table, and submitted for analysis. Soil samples will be analyzed for the following reduced list of Appendix IX analyses.

#### Appendix IX

SW8260B
 SW8270C
 SVOCs

• SW6010B/7000 - trace elements (metals)

• SW7471A - mercury

The proposed soil analyses for the site are summarized in Table 3.4.

Additional soil borings may be installed at a later date to further delineate the extent of any contamination found to be originating from AOC 19.

If the initial soil investigation indicates that a release has occurred at AOC 19, monitoring wells may be installed using a HSA. Each monitoring well will be completed 1- foot into the bedrock. The monitoring well pattern will consist of one upgradient well and three downgradient wells. Groundwater will be collected from the newly installed wells and from the existing monitoring well WHGLTA801, and will be analyzed for a reduced list of Appendix IX analyses based on the results of the initial soil investigation. Three rounds of groundwater sampling will be conducted at approximately 2-month intervals. Analytical data will be used to assess if contaminants at AOC 19 have impacted the groundwater.

#### 4.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Figure 4.1 shows the project organization, reporting relationships, and lines of authority. Table 4.1 lists key project personnel and their respective telephone numbers. Other personnel will be assigned as necessary. The specific responsibilities are described in the following subsections.

#### 4.1 MANAGEMENT RESPONSIBILITIES

#### 4.1.1 Program Manager

The Program Manager's responsibilities will include the following:

- Reviewing and approving the WP, QAPP, FSP, and Health and Safety Plan (HSP)
- Providing sufficient resources to the project team so that it can respond fully to the requirements of the investigation
- Providing direction and guidance to the PM
- Reviewing the final project report
- Providing other responsibilities as requested by the PM

#### 4.1.2 Project Manager

The PM will be the prime point of contact with AFCEE and will have primary responsibility for technical, budget, and scheduling matters. PM duties will include:

- Reviewing and approving project plans and reports
- Assigning duties to the project staff and orienting the staff to the needs and requirements of the project
- Obtaining the approval of the QA Manager for proposed variances to the WP and **FSP**
- Supervising the performance of project team members
- Providing budget and schedule control
- Reviewing subcontractor work and approving subcontract invoices
- Ensuring that major project deliverables are reviewed for technical accuracy and completeness before their release, including data validity

- Ensuring that all resources of the laboratory are available on an as-required basis
- Overseeing final analytical reports

#### 4.2 OA AND HEALTH AND SAFETY RESPONSIBILITIES

#### 4.2.1 QA Manager

Responsibilities of the QA Manager will include:

- Serving as official contact for QA matters for the project
- Identifying and responding to QA/QC needs and problem resolution needs
- Answering requests for guidance or assistance
- Reviewing, evaluating, and approving the FSP and QAPP and all changes to these documents
- Verifying that appropriate corrective actions are taken for all nonconformances
- Verifying that appropriate methods are specified in the FSP and QAPP for obtaining data of known quality and integrity
- Fulfilling other responsibilities as requested by the PM
- Evaluating subcontractor quality program
- Training staff on QA subjects
- Supervising staff in QA Program related tasks
- Recommending changes in the QA Program

#### 4.2.2 Health and Safety Officer

Responsibilities of the Health and Safety Officer (HSO) will include:

- Developing the HSP
- Ensuring that the requirements of the QAPP are satisfied
- Providing other responsibilities as identified in the HSP

#### 4.3 LABORATORY RESPONSIBILITIES

#### 4.3.1 Laboratory Project Manager

The laboratory's PM will report directly to HydroGeoLogic's PM and will be responsible for the following:

- Ensuring that all resources of the laboratory are available on an as-required basis
- Overseeing final analytical reports

#### 4.3.2 Laboratory Operations Manager

The laboratory's Operation Manager will report to the laboratory's PM and will be responsible for the following:

- Coordinating laboratory analyses
- Supervising in-house chain-of-custody (COC)
- Scheduling sample analyses
- Overseeing data review
- Overseeing preparation of analytical reports
- Approving final analytical reports prior to submission to HydroGeoLogic

#### 4.3.3 Laboratory QA Officer

The laboratory's QA officer has the overall responsibility for data after it leaves the laboratory. The QA officer will be independent of the laboratory but will communicate data issues through the laboratory's PM. In addition, the QA officer will be responsible for the following:

- Conduct audits of laboratory analyses
- Provide oversight of laboratory OA
- Provide oversight of QA/QC documentation
- Conduct detailed reviews of data
- Determine whether to implement laboratory corrective actions, if required
- Define appropriate laboratory QA procedures

Prepare laboratory Standard Operation Procedures

#### 4.3.4 Laboratory Sample Custodian

The laboratory's Sample Custodian will report to the Operations Manager. Responsibilities of the Sample Custodian will include:

- Receiving and inspecting the incoming sample containers
- Recording the condition of the incoming sample containers
- Signing appropriate documents
- Verifying COC and its correctness
- Notifying laboratory manager and laboratory supervisor of sample receipt and inspection
- Assigning a unique identification number and customer number, and entering each into the sample receiving log
- Initiating transfer of the samples to appropriate lab sections with the help of the laboratory operations manager
- Controlling and monitoring access/storage of samples and extracts

#### 4.4 FIELD RESPONSIBILITIES

#### 4.4.1 Project Geologist

The Project Geologist will be responsible for geologic interpretations as well as acting as lead coordinator for field activities. The Project Geologist's duties and responsibilities will include:

- Providing orientation and any necessary training to field personnel (including subcontractors) on the requirements of the FSP, HSP, and QAPP before the start of work
- Providing direction and supervision to the sampling crews
- Monitoring sampling operations to ensure that the sampling team members adhere to the QAPP and FSP
- Ensuring the use of calibrated measurement and test equipment
- Maintaining a field records management system

- Coordinating activities with the PM
- Supervising geological data interpretation activities
- Overseeing field data documentation and conducting quality checks on interpretive geologic work products
- Reviewing reports for compliance with State of Texas and EPA requirements
- Assuming the duties of the HSO if directed by the HSO

#### 4.5 SUBCONTRACTORS

Subcontractors will be used for the laboratory analyses, and the drilling of soil borings and monitoring wells during the field investigation.

Qualified subcontractors will be selected in accordance with AFCEE requirements and HydroGeoLogic procurement and QA procedures. Subcontractors will meet predetermined qualifications developed by the PM and defined in the procurement bid packages. Each bid submitted will be reviewed for technical, QA, and purchasing requirements. All subcontractors will be required to follow the procedures of the WP, FSP, QAPP, and HSP. Periodic QC inspections of each subcontractor may be performed as specified in the FSP (Section 7.4), QAPP (Section 9.1), and HSP (Section 1.3.2). These inspections will be performed by the QA Manager, or his designee, as unannounced audits to confirm adherence to the procedures and guidance outlined in the aforementioned documents. Such inspections may relate to health and safety, QAPP requirements, or field standard operating procedures.

#### 5.0 FIELD OPERATIONS

The overall project field logistics and activities necessary to complete the project sampling objectives described in the WP are presented in this section. All field work will be conducted in accordance with the site HSP. HydroGeoLogic is the prime contractor for the field investigation. The point-of-contact (POC) at the Base will be Mr. Michael Dodyk.

#### 5.1 GEOLOGIC STANDARDS

The lithologic descriptions for consolidated materials (igneous, metamorphic, and sedimentary rocks) shall follow the standard professional nomenclature (cf. Tennissen, A.C., 1983, Nature of Earth Materials, 2nd Edition, p. 204-348), with special attention given to describing fractures, vugs, solution cavities and their fillings or coatings, and any other characteristics affecting permeability. Colors shall be designated by the Munsell Color System.

The lithologic descriptions for unconsolidated materials (soils [engineering usage] or deposits) shall use the name of the predominant particle size (e.g., silt, fine sand, etc.). The dimensions of the predominant and secondary sizes shall be recorded using the metric system. The grain size and name of the deposit shall be accompanied by the predominant mineral content, accessory minerals, color, particle angularity, and any other characteristics. The classic deposit descriptions shall include, as a supplement, symbols of the Unified Soil Classification System (USCS). The color descriptions shall be designated by the Munsell Color System.

The scales for maps, cross sections, or 3-D diagrams shall be selected in accordance with the geologic and hydrologic complexity of the area and the purposes of the illustrations. Geophysical logs shall be run at a constant vertical scale of 1 inch equals 20 feet. When geophysical logs are superimposed on geologic logs, cross sections, or 3-D diagrams, the scales shall be the same. If defining geological conditions requires other scales, additional logs at those scales shall be provided.

For orientation, the cross sections shall show the northern end on the viewer's right. If the line of cross section is predominantly East-West, the eastern end is on the right. Maps shall be oriented with North toward the top, unless the shape of the area dictates otherwise. The orientation will be indicated with a North arrow.

#### 5.2 SITE RECONNAISSANCE, PREPARATION, AND RESTORATION PROCEDURES

Areas designated for intrusive sampling shall be surveyed for the presence of underground utilities. Utility locations are determined using existing utility maps and are verified in the field using a hand-held magnetometer or utility probe. Prior to commencement of drilling activities, digging permits will be obtained from NAS Fort Worth JRB. The base civil engineer will be contacted to verify that selected locations are free of underground utilities. Those locations not clear of underground utilities will be relocated to achieve clearance, and then verified for clearance a second time. Vehicle access routes to sampling locations shall be determined prior to any field activity.

A centralized decontamination area shall be provided for drilling rigs and equipment. The decontamination area shall be large enough to allow storage of cleaned equipment and materials prior to use, as well as to stage drums of decontamination waste. The decontamination area shall be lined with a heavy gauge plastic sheeting, and designed with a collection system to capture decontamination waters. Solid wastes shall be accumulated in 55-gallon drums and subsequently transported to a waste storage area designated by the USAF. Smaller decontamination areas for personnel and portable equipment shall be provided as necessary. These locations shall include basins or tubs to capture decontamination fluids, which shall be transferred to a large accumulation tank as necessary. These designated areas of decontamination shall be determined during the preconstruction meeting. The field office and the primary staging area for field equipment and supplies will be located at 6560 White Settlement Road.

Each work site or sampling location shall be returned to its original condition when possible. Efforts shall be made to minimize impacts to work sites and sampling locations, particularly those in or near sensitive environments such as wetlands. Following the completion of work at a site, all drums, trash, and other waste shall be removed. Decontamination and/or rinse water and soil cuttings shall be transported to the designated locations as described in Section 5.9. At the completion of field activities, all capital equipment and consumable materials will be removed or turned over to base personnel in accordance with AFCEE procedures. A final site walk will be conducted with the base representative, at his/her discretion, to ensure that all sampling locations have been restored satisfactorily before final demobilization from the site.

### 5.3 BOREHOLE DRILLING, LITHOLOGIC SAMPLING, LOGGING, AND ABANDONMENT

#### 5.3.1 General Drilling Procedures

All drilling activities shall conform with state and local regulations and will be supervised by a professional geologist or engineer. HydroGeoLogic will obtain and pay for all permits, applications, and other documents required by state and local authorities.

The location of all borings will be coordinated, in writing, with the base civil engineer, or equivalent, before drilling commences. Soil borings will be installed using either HSA drilling or DPT. When installing boreholes through more than one water bearing zone or aquifer,

HydroGeoLogic and its subcontractors will take measures to prevent cross-connection or cross-contamination of the zones or aquifers.

Drilling fluids shall not be used for this project unless prior authorization is obtained by the TNRCC or the EPA. A log of drilling activities will be kept in a bound field notebook. Information in the log book will include location, time on site, personnel and equipment present, down time, materials used, samples collected, measurements taken, and any observations or information that would be necessary to reconstruct field activities at a later date. At the end of each day of drilling, the drilling supervisor will complete a Log of Daily Time and Materials Form. An example of this form is provided in Appendix D of the WP.

HydroGeoLogic will dispose of all trash, waste grout, cuttings, and drilling fluids as coordinated with the base civil engineer or NAS Fort Worth JRB representative.

### 5.3.2 Sampling and Logging

The lithology in all boreholes will be logged. The boring log form will be used for recording the lithologic logging information. Information on the boring log sheet includes the borehole location, drilling information, sampling information (such as sample intervals), recovery, blow counts (if applicable), and sample description information.

Unconsolidated samples for lithologic description will be obtained continuously at 5-foot intervals using split spoon samplers and standard penetration tests. Lithologic descriptions of unconsolidated materials encountered in the boreholes will generally be described in accordance with American Society for Testing and Materials (ASTM) D-2488-90 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM, 1990). Descriptive information to be recorded in the field will include the following: (1) identification of the predominant particles: size and range of particle sizes, (2) percent of gravel, sand, fines, or all three, (3) description of grading and sorting of coarse particles, (4) particle angularity and shape, and (5) maximum particle size or dimension.

Plasticity of fines description include the following: (1) color using Munsell Color System, (2) moisture (dry, wet, or moist), (3) consistency of fine grained soils, (4) structure of consolidated materials, and (5) cementation (weak, moderate, or strong).

Identification of the USCS group symbol will be used. Additional information to be recorded includes the depth to the water table, caving or sloughing of the borehole, changes in drilling rate, depths of laboratory samples, presence of organic materials, presence of fractures or voids in consolidated materials, and other noteworthy observations or conditions, such as the locations of geologic boundaries.

All samples will be monitored with an organic vapor monitor (e.g., photoionization detector (PID), organic vapor analyzer (OVA)). The samples shall be handled in such a way as to minimize the loss of volatiles; these procedures are described in Section 6.2. Cuttings will be examined for their hazardous characteristics. Materials suspected to be hazardous because of

abnormal color, odor, or organic vapor monitor readings will be containerized in conformance with RCRA, state, and local requirements.

### 5.3.3 Abandonment

Boreholes will be abandoned in accordance with 30 Texas Administrative Code (TAC) Chapter 238, Water Well Driller Rules (TNRCC, 1997). Since the borings will not exceed 100 feet, the boring will be plugged to the ground surface with a solid column of 3/8 inch or larger granular sodium bentonite. The granular bentonite shall be hydrated at frequent intervals while strictly adhering to the manufacturer's specifications (TNRCC, 1997).

All abandoned boreholes will be checked 24 to 48 hours after mud/solid bentonite emplacement to determine whether curing is occurring properly. More specific curing specifications may be recommended by the manufacturer and will be followed. If settling has occurred, a sufficient amount of bentonite will be added to fill the hole to the ground surface. Curing checks and any addition of bentonite will be recorded in the field log.

### 5.4 MONITORING WELL CONSTRUCTION

The on-site Project Geologist will supervise the drilling, soil boring, geophysical surveys, lithologic sampling, and monitoring well construction. Although floating petroleum products (i.e., light non-aqueous phase liquids (LNAPLs)) are not anticipated, shallow monitoring wells shall be screened across the water table if they are encountered. The length of the screen will be such that tidal and seasonal water table fluctuations shall not cause water levels to rise above or fall below the screened interval. If dense petroleum products (i.e., dense non-aqueous phase liquids (DNAPLs)) are encountered, monitoring wells will be screened at the bottom of the aquifer to capture the DNAPL.

### 5.4.1 Drilling Requirements

All drilling and well installations will conform to state and local regulations, and HydroGeoLogic will obtain and pay for all permits, applications, and other documents required by state and local authorities. The location of all borings will be coordinated in writing with the base civil engineer, or equivalent, before drilling commences.

The DPT and HSA rigs to be used will be cleaned and decontaminated according to the guidelines described in Section 5.9. The rig will not leak any fluids that may enter the borehole or contaminate equipment that is placed in the hole. Rags or absorbent materials will not be used to absorb leaking fluids.

HydroGeoLogic and its drilling subcontractors will dispose of all trash, waste grout, cuttings, and drilling fluids as coordinated with the base civil engineer or representative. Monitoring wells will be completed in the alluvial terrace groundwater only, thereby preventing cross-connection or cross-contamination of other water bearing zones or aquifers.

### 5.4.2 Monitoring Well Borehole Requirements

HSA drilling is to be used to install monitoring wells for this project. The inside diameter of the auger will be at least 4 inches larger than the outside diameter of the casing and well screen.

The completed monitoring wells will be sufficiently straight to allow passage of pumps or sampling devices and will be pumped within 1 degree of vertical where the water level is greater than 30 feet below land surface, unless otherwise approved by AFCEE. AFCEE may waive a plumbness requirement. Any request for a waiver from straightness or plumbness specifications will be made in writing to AFCEE, in advance of mobilization for drilling. HydroGeoLogic or its drilling subcontractor will use a single-shot declination tool to demonstrate plumbness. Monitoring wells not meeting straightness or plumbness specifications will be redrilled and/or reconstructed.

Formation samples for lithologic description will be obtained continuously at 5-foot sampling intervals. All samples will be monitored with an organic vapor monitor (e.g., PID, OVA). The samples will be handled in such a way as to minimize the loss of volatiles; these procedures will be described in Section 6.2. Cuttings will be examined for their hazardous characteristics. Materials that are suspected to be hazardous because of abnormal color, odor, or organic vapor monitor readings shall be containerized in conformance with RCRA, state, and local requirements. The documentation record and forms (Appendix D in the WP) will document the following information for each boring: (1) boring or well identification (this identification shall be unique, and HydroGeoLogic will ensure it has not been used previously at the installation.), (2) purpose of the boring (e.g., soil sampling, monitoring well), (3) location in relation to an easily identifiable landmark, (4) names of drilling contractor and logger, (5) start and finish dates and times, (6) drilling method, (7) types of drilling fluids and depths at which they were used (not applicable to the drilling method used for this project), (8) diameters of surface casing, casing type, and methods of installation, (9) depth at which saturated conditions were first encountered, (10) lithologic descriptions and depths of lithologic boundaries, (11) sampling-interval depths, (12) zones of caving or heaving, (13) drilling rate, and (14) drilling rig reactions, such as chatter, rod drops, and bouncing.

A standard penetration test shall be performed each time a split spoon sample is taken. The test shall be performed in accordance with ASTM D-1586.

### 5.4.3 Casing Requirements

The casing requirements that will be followed are the following: (1) all casing will be new, unused, and decontaminated according to the specifications of Section 5.9, (2) glue will not be used to join casing, and casings will be joined only with compatible welds or couplings that shall not interfere with the planned use of the well, (3) all polyvinyl chloride (PVC) will conform to the ASTM Standard F-480-88A or the National Sanitation Foundation Standard 14 (Plastic Pipe System), (4) the casing will be straight and plumb within the tolerance stated for the borehole, and (5) the driller shall cut a notch in the top of the casing to be used as a measuring point for water levels.

All monitoring wells for this project will be constructed using flush threaded two-inch diameter Schedule 40 PVC casing. The notches cut in the top of the monitoring well casings for water level measuring points will be oriented on the north side of each casing for uniformity.

### 5.4.4 Well Screen Requirements

AFCEE well screen requirements are the following: (1) all requirements that apply to casing will also apply to well screen, except for strength requirements, (2) monitoring wells will not be screened across more than one water-bearing unit, (3) screens will be factory slotted or wrapped, (4) screen slots will be sized to prevent 90 percent of the filter pack from entering the well, and (5) the bottom of the screen is to be capped, and the cap will be joined to the screen by threads.

The monitoring wells will be constructed using flush-threaded two-inch diameter Schedule 40 PVC casing and screen. The upper 20 feet of the uppermost flow zone of the uppermost aquifer will be screened with 0.010 inch continuous slotted PVC. No well screen will be over 20 feet in length, however, every effort will be made to install monitoring wells with a maximum screen length of 10 feet. It is anticipated that well screens will be placed from the lowest portion of the alluvial terrace groundwater zone through the surface of the water table. The bottom of the screen will be capped using a flush threaded PVC cap.

### 5.4.5 Annular Space Requirements

The annular space requirements are the following: (1) the annular space will be filled with a filter pack, a bentonite seal, and casing grout between the well string and the borehole wall, and (2) as the annular space is being filled, the well string will be centered and suspended such that it does not rest on the bottom of the hole, and for wells greater than 50 feet deep, at least two stainless steel centralizers will be used, one at the bottom and one at the top of the screen. Additional centralizers will be used as needed.

### 5.4.6 Filter Pack Requirements

The filter pack will consist of silica sand or gravel and will extend from the bottom of the hole to at least 2 feet above the top of the well screen. After the filter pack settles the top of the sand pack will be sounded to verify its depth during placement. Additional filter pack will be emplaced as required to return the level of the pack to 2 feet above the screen.

The filter pack material will be clean, inert, and well-rounded and will contain less than 2 percent flat particles. The sand will be certified free of contaminants by vendor or contractor. If decontamination is necessary, the methods shall be approved in writing by AFCEE.

The filter pack will have a grain size distribution and uniformity coefficient compatible with the formation materials and the screen. This will be calculated as described in Chapter 12, Ground Water and Wells, 2nd Edition (Driscoll, 1986). The grain size of the filter pack material will be determined based on existing grain size analysis prior to mobilization to the field. The filter pack will not extend across more than one water-bearing unit. In all wells (deep or shallow), the filter

pack will be emplaced with a bottom discharge tremie pipe of at least 1½ inches in diameter to prevent bridging. The tremie pipe will be lifted from the bottom of the hole at the same rate the filter pack is set. HydroGeoLogic will record the volume of the filter pack emplaced in the well. If potable water is necessary to place the filter pack, HydroGeoLogic will obtain prior approval from the regulatory agency providing oversight, and will ensure that no contaminants are introduced into the well.

### 5.4.7 Bentonite Seal Requirements

The bentonite seal requirements that will be followed are the following: (1) the bentonite seal will consist of at least 2 feet of bentonite between the filter pack and the casing grout, (2) the bentonite will be hydrated before placement and shall be installed by pump tremie methods, and (3) only 100 percent sodium bentonite shall be used.

### 5.4.8 Casing Grout Requirements

The casing grout requirements are the following: (1) the casing grout will extend from the top of the bentonite seal to ground surface, (2) the grout will be mixed in the following proportions: 94 pounds of neat Type I Portland or American Petroleum Institute Class A cement, not more than 4 pounds of 100 percent sodium bentonite powder, and not more than 8 gallons of potable water, (3) all grout will be pump tremied using a side-discharge tremie pipe, and pumping will continue until 20 percent of the grout has been returned to the surface, and (4) in wells where the bentonite seal is visible and within 30 feet of the land surface, the 20 percent return is not necessary so long as the tremie pipe is pulled back as the grout is emplaced.

### 5.4.9 Surface Completion Requirements

For flush-mounted completions, the casing will be cut about three inches below the land surface and provide a water-tight casing cap to prevent surface water from entering the well. To allow for escape of gas, a small diameter (e.g., ¼-inch) vent hole will be placed in the upper portion of the casing, or a ventilated well cap will be used. A freely draining valve box with a locking cover will be placed over the casing. The top of the casing will be at least one foot above the bottom of the box. The valve box lid will be centered in a three-foot diameter, four-inch thick concrete pad that slopes away from the box at ¼ inch per foot. The identity of the well will be permanently marked on the valve box lid and the casing cap. Where heavy traffic may pass over the well or for other reasons, the concrete pad and valve box/lid assembly will be constructed to meet the strength requirements of surrounding surfaces.

When above-ground surface completion is used, the well casing will be extended 2 or 3 feet above land surface. A casing cap will be provided for each well, and the extended casing will be shielded with a steel sleeve that is placed over the casing and cap and seated in a 3- by 3-foot by 4-inch concrete surface pad. To allow for escape of gas, a small diameter (e.g., 1/4-inch) vent hole will be placed in the well casing, or a ventilated well cap will be used. The concrete surface pad will be reinforced with steel reinforcing bars at least 1/4 inch in diameter. The ground surface will be freed of grass and scoured to a depth of 2 inches before setting the concrete pad. The diameter of the sleeve will be at least 6 inches greater than the diameter of the casing. The pad

will be sloped away from the well sleeve. A lockable cap or lid will be installed on the guard pipe. The identity of the well will be permanently marked on the casing cap and the protective sleeve. Three 3-inch diameter concrete-filled steel guard posts, each 5 feet in total length, will be installed radially from each well head. The guard posts will be recessed approximately 2 feet into the ground and set in concrete. The guard posts will not be installed in the concrete pad placed at the well base. The protective sleeve and guard posts will be painted with a color specified by the installation civil engineer.

All wells will be secured as soon as possible after drilling with corrosion-resistant locks for both flush and above-ground surface completions. The locks will either have identical keys or be keyed for opening with one master key. The lock keys will be delivered to the appropriate Air Force personnel following completion of the field effort. A Monitoring Well Construction Form will be completed for each well. Examples of field forms are presented in Appendix D of the WP.

### 5.5 MONITORING WELL DEVELOPMENT

The monitoring well development requirements are the following: (1) all newly installed monitoring wells will be developed no sooner than 24 hours after installation to allow for grout curing, (2) all drilling fluids used during well construction will be removed during development, (3) wells will be developed using surge blocks and bailers or pumps (prior approval for any alternate method will be obtained, in writing, from AFCEE before well construction begins), and wells will be developed until the turbidity of the well is less than or equal to 10 nephelometric turbidity units (NTU) and remains within a 5 NTU range for at least 30 minutes and the stabilization criteria in Section 6.1 are met, (4) discharge water color and volume will be documented, (5) no sediment will remain in the bottom of the well, (6) no detergents, soaps, acids, bleaches, or other additives will be used to develop a well, and (7) all development equipment will be decontaminated according to the specifications of Section 5.9.

### 5.6 ABANDONING MONITORING WELLS

All abandonment of monitoring wells, when necessary, shall be performed in accordance with state and local laws and regulations. If slurry is used, a mud balance and/or Marsh Funnel will be used to ensure that the density (lbs/gal) of the abandonment mud mixture conforms with the manufacturer's specification. All abandoned monitoring wells will be checked 24 to 48 hours after mud/solid bentonite emplacement to determine whether curing is occurring properly. More specific curing specifications or quality assurance checks may be recommended by the manufacturer and will be followed. Additionally, if significant settling has occurred, a sufficient amount of mud/solid bentonite will be added to attain its initial level. These slurry/solid bentonite curing checks and any addition of mud/solid bentonite will be recorded in the field logs.

### 5.7 GEOPHYSICAL INVESTIGATIONS

Three geophysical surveys methods will be utilized during this investigation; two EM methods and a magnetic method. An EM metal detection survey which detects both ferrous and nonferrous metals will be performed at SWMU 21. An EM survey and a magnetic survey will be performed

at AOC 17. The EM survey at AOC 17 will measure the conductivity of a subsurface volume, which is a function of the soil or rock type, the porosity, and the pore fluid content. The measured values, referred to as apparent or terrain conductivity, are obtained without direct ground contact by EM induction. The magnetic survey at AOC 17, which measures the total magnetic field intensity and vertical magnetic gradient, will be used to locate buried ferrous objects such as tanks, pipelines, and metallic debris.

### 5.7.1 General Requirements for Geophysical Surveys

All geophysical surveys will include the following:

- A professional geologist or engineer will be provided by HydroGeoLogic to supervise the project.
- The locations of surface geophysical grid system layouts shall be shown on a site map.
- Final results shall be presented in plain views and cross sections and contours shall be used where appropriate.
- The interpretation of results shall discuss positive and negative results, as well as limitations of the method and data.
- The interpretation of the data shall be incorporated into the conceptual site model.

### 5.7.2 Electromagnetic Methods

### **5.7.2.1 Geonics EM61**

The Geonics EM61 is a time domain metal detector that detects both ferrous and non-ferrous metals. The response to an isolated buried metal object is a quick, sharply-defined peak, facilitating quick and accurate location of the object. In addition, the EM61 is relatively insensitive to nearby cultural interferences such as fences, buildings, and power lines although if present, such objects could still obscure an UST. Consequently, the EM61 is ideal for confirming the presence or absence of the abandoned USTs.

A systematic grid, typically oriented approximately north-south, will be established at each site as shown on Figure 3.1, using a tape measure for distance and a transit for trueness. The grid location will be based on the location of existing structures, and will be supplemented by a review of historic maps. The grid location, orientation, and size may be modified based on field observations, such as surface depressions or variations in vegetation. Grid lines will be spaced every 10 feet; however, grid points will be marked with pin flags or fluorescent paint at a spacing of 40 feet. Wooden stakes will be placed as temporary location markers to locate the grid for future reference. The location and elevation of the wooden stakes will be surveyed and correlated to existing coordinate systems, and a sketch of surface features will be drawn in the field to facilitate the geophysical interpretation. The survey procedure will consist of carrying the instruments along lines to effectively provide a 5-foot line spacing. Data will be digitally recorded approximately every 5 feet along lines except where prevented by obstructions.

### 5.7.2.2 **Geonics EM31**

The Geonics EM31 is a conductivity meter with a digital data recorder. The EM31 is a portable instrument designed for shallow geophysical applications, which measures the electrical conductivity of the subsurface. The principle of operation is the induction of an EM signal of known frequency into the subsurface through a transmitting coil. A receiver coil, a known distance away, monitors the resultant signal. The measuring instrument compares the transmitted and received signals, and produces an output voltage that is proportional to the subsurface conductivity. Both the in-phase and out-of-phase portions of the received signal are measured. The apparent conductivity is linearly related to the out-of-phase (quadrature) component and is measured in millisiemens per meter (mS/m). The in-phase component, measured in parts per thousand (ppt), is sensitive to the presence of conductive bodies, typically buried metallic objects such as tanks, pipes, drums, etc. However, the EM31 may also be affected by "cultural noise", such as power lines, fences, and buildings.

A systematic grid, typically oriented approximately north-south, will be established at each site as shown on Figure 3.3, using a tape measure for distance and a transit for trueness. The grid location will be based on the location of existing structures, and will be supplemented by a review of available aerial photographs. The grid location, orientation, and size may be modified based on field observations, such as surface depressions or variations in vegetation. Grid lines will be spaced every 20 feet, with grid points marked at a spacing of 40 feet. Wooden stakes will be placed as temporary location markers to locate the grid for future reference. The location and elevation of the wooden stakes will be surveyed and correlated to existing coordinate systems, and a sketch of surface features will be drawn in the field to facilitate the geophysical interpretation. The survey procedure will consist of carrying the instruments along lines to effectively provide a 10-feet line spacing. Data will be digitally recorded approximately every 10 feet along lines except where prevented by obstruction.

### 5.7.3 Magnetic Methods

Magnetic surveys will be performed using a Gem Systems GSM-19 magnetometer/gradiometer (or equivalent). The GSM-19 is a portable magnetometer that is capable of measuring the earth's total magnetic field intensity and the vertical magnetic gradient. The vertical magnetic gradient measures the difference in the total magnetic field intensity between two sensors positioned at different fixed heights above the ground. Buried metallic objects perturb the local magnetic field and produce short wavelength anomalies. However, the magnetometer may also be affected by cultural noise, such as power lines, fences, and buildings. The total magnetic field intensity, measured in nanotelsas (nT), and the vertical magnetic field gradient, measured in nT per meter (nT/m), will be digitally recorded in a "continuous" or walking mode. A magnetic base station will be established at each site to correct for diurnal variations in the earth's magnetic field.

A systematic grid, typically oriented approximately north-south, will be established at each site as shown on Figure 3.3, using a tape measure for distance and a transit for trueness. The grid location will be based on the location of existing structures, and will be supplemented by a review of available aerial photographs. However, the grid location, orientation, and size may be modified

based on field observations, such as surface depressions or variations in vegetation. Grid lines will be spaced every 20 feet, with grid points marked at a spacing of 40 feet. Wooden stakes will be placed as temporary location markers to locate the grid for future reference. The location and elevation of the wooden stakes will be surveyed and correlated to existing coordinate systems, and a sketch of surface features will be drawn in the field to facilitate the geophysical interpretation. The survey procedure will consist of carrying the instruments along lines to effectively provide a 10-feet line spacing. Data will be digitally recorded approximately every 10 feet along lines except where prevented by obstruction.

### 5.7.4 Data Interpretation

The geophysical data will be downloaded and evaluated in the field for data quality, and to make preliminary interpretations. Corrections for diurnal variations in the earth's magnetic field will be applied to the magnetic data before evaluation. The results will be gridded and contoured, and displayed as contour maps and 3-D mesh diagrams to identify anomalous areas. Descriptions of the instruments used during the geophysical surveys, the methods of data collection, and an interpretation of the data will be provided in an appendix and summarized in the RFI/SI report.

### 5.8 **SURVEYING**

All surveying locations of field activities will be measured by a state of Texas certified land surveyor. The surveys will be third order and references will be tied to the Texas State Plane Coordinate System (cf. Urquhart, L.C., 1962 Civil Engineering Handbook, 4th Edition, p. 96 and 97). All surveyed locations will be reported using the Texas State Plane Coordinate System, North Central Zone. The horizontal datum will be the North American Datum of 1983 and the units will be in U.S. Survey feet. The vertical datum will be the National Geodetic Vertical Datum (NGVD) of 1988 and the units will be in U.S. survey feet. The surveyed control information for all data collection points will be recorded and displayed in a table. The table will give the northing (Y) and easting (X) coordinates, the ground elevation and the measuring point elevation if the location is a groundwater monitoring well. The reference location is the origin. The elevation of all newly installed wells will be surveyed at the water level measuring point (notch) on the riser pipe. The elevation of the ground surface at each water level measuring point will be included in the survey. The accuracy of the X-Y coordinates for each sample location will be accurate to within 0.1 feet.

### 5.9 **EQUIPMENT DECONTAMINATION**

All equipment that may directly or indirectly contact samples will be decontaminated in a designated decontamination area. This includes casing, drill bits, auger flights, portions of drill rigs that stand above boreholes, sampling devices, and instruments, such as slugs and sounders. In addition, HydroGeoLogic and its subcontractors will take care to prevent the sample from coming into contact with potentially contaminating substances such as tape, oil, engine exhaust, corroded surfaces, and dirt.

The following procedure will be used to decontaminate large pieces of equipment such as casings, auger flights, pipe and rods, and those portions of the drill rig that may stand directly over a boring or well location or that come into contact with casing, auger flights, pipe, or rods. The external surfaces of equipment will be washed with high-pressure hot water and Alconox<sup>TM</sup>, or equivalent laboratory-grade detergent, and if necessary, scrubbed until all visible dirt, grime, grease, oil, loose paint, rust flakes, etc., have been removed. The equipment will then be rinsed with potable water. The inside surfaces of casing, drill rod, and auger flights will also be washed as described.

The following procedure will be used to decontaminate sampling and drilling devices such as split spoons and augers that can be hand-manipulated. For sampling and smaller drilling devices, the equipment will be scrubbed with a solution of potable water and Alconox<sup>TM</sup>, or equivalent laboratory-grade detergent. The equipment will then be rinsed with copious quantities of potable water followed by a rinse with ASTM Type II reagent-grade water. High pressure liquid chromatograph-grade water and distilled water purchased in stores are not acceptable substitutes for ASTM Type II Reagent-Grade Water. The equipment will then be rinsed with pesticide-grade methanol followed by a rinse with pesticide-grade hexane. The equipment will then be allowed to air dry on a clean surface or rack, such as Teflon<sup>®</sup>, stainless steel, or oil-free aluminum, elevated at least 2 feet above ground. If the sampling device will not be used immediately after being decontaminated, it will be wrapped in oil-free aluminum foil, or placed in a closed container made of stainless steel, glass, or Teflon<sup>®</sup>.

Reagent-Grade II water, methanol, and hexane will be purchased, stored, and dispensed only in glass, stainless steel, or Teflon\* containers. These containers will have Teflon\* caps or cap liners. HydroGeoLogic and its subcontractors will assure that these materials remain free of contaminants. If any question of purity exists, new materials will be used.

All fluids generated during decontamination activities will be placed in United Nations (UN)-approved steel 55-gallon drums. All drums will be properly labeled as to content and shall be staged in a central location designated by the base representative for temporary storage pending removal and disposal.

### 5.10 WASTE HANDLING

Waste handling will be dealt with on a site-by-site basis. Waste will be classified as either non-investigative waste or investigative waste per the requirements of 30 TAC §335 Subchapter R and 40 Code of Federal Regulations (CFR) Part 261, Subpart C. Non-investigative waste, such as litter and household garbage, will be collected on an as-needed basis to maintain each site in a clean and orderly manner. This waste will be containerized and transported to the designated sanitary landfill or collection bin. Acceptable containers will be sealed boxes or plastic garbage bags.

Waste containers will be labeled with the following information: type of matrix being contained, depth from which matrix was obtained, date matrix was contained, company name and phone number, and whether matrix is considered hazardous or not.

Characterization of investigative derived waste (IDW) will be based on sample analysis obtained during the field investigation following EPA approved methods. Hazardous waste classification will first be determined as per 40 CFR §261.2, §261.3, or §261.4. Waste that is nonhazardous. is then classified as Class 1, Class 2, or Class 3 according to 30 TAC §335.505 - 335.507. Once the IDW has been characterized, an eight digit waste code number will be provided as required in §335.501. The disposal of IDW will be conducted in a timely and cost effective manner, and in accordance with all state and federal regulations.

IDW will be properly containerized and temporarily stored at each site, prior to transportation. Depending on the constituents of concern, fencing or other special markings may be required. The number of containers will be estimated on an as-needed basis. Acceptable containers will be sealed in either 55-gallon drums or small dumping bins with lids. The containers will be transported in such a manner to prevent spillage or particulate loss to the atmosphere.

The IDW will be segregated at the site according to matrix (solid or liquid) and as to how it was derived (drill cuttings, drilling fluid, decontamination fluids, and purged groundwater). Each container will be properly labeled with site identification, sampling point, date, depth, matrix, constituents of concern, and other pertinent information for handling.

Waste generated during the field activities will be handled and disposed of in accordance with applicable federal, state, and local regulations. Disposable materials such as latex gloves, aluminum foil, paper towels, etc., shall be placed and sealed in plastic garbage bags for disposal with sanitary waste from the site. Soil cuttings will be placed in 55-gallon steel open top drums with lids. Development and purge waters evacuated from groundwater monitoring wells, and all fluids generated during decontamination activities, will be placed in 55-gallon steel drums or equivalent. Drums will be properly labeled with the appropriate boring or well number, and content, and will be staged in a central location designated by the base representative for temporary storage pending removal and disposal.

### HYDROGEOLOGICAL CONCEPTUAL MODEL 5.11

For the RFI investigations the project geologist or engineer will develop a base and site geological and hydrological conceptual model from pre-existing USGS, regional, state, and local studies and information developed during the project. Maps and cross sections will be used to depict the conceptual model. The model will be the basis for evaluating soil boring and monitoring well locations, contaminant distribution (plume delineation), and the closeness of fit to natural conditions of analytical models.

### 5.12 CORRECTIVE ACTION

Table 5.1 contains a summary of field quality control procedures and corrective actions.

### 6.0 ENVIRONMENTAL SAMPLING

### 6.1 SAMPLING PROCEDURES

All purging and sampling equipment will be decontaminated according to the specifications in Sections 5.9 and 7.3 prior to any sampling activities and will be protected from contamination until ready for use. The construction material of the sampling devices (e.g., plastic, PVC, metal, etc.) discussed below will be appropriate for the contaminant of concern and shall not interfere with the chemical analyses being performed.

### 6.1.1 Groundwater Sampling

When numerous monitoring wells are to be sampled in succession, wells expected to have low levels of contamination or no contamination will be sampled prior to wells expected to have higher levels of contamination. This practice will help reduce the potential for cross contamination between wells. All sampling activities will be recorded in the field log book. Additionally, all sampling data will be recorded on a Field Sampling Report form.

Before groundwater sampling begins, wells will be inspected for signs of tampering or other damage. If tampering is suspected, (i.e., casing is damaged, lock or cap is missing) this shall be recorded in the field log book and on the well sampling form, and reported to the Project Geologist/Field Coordinator. Wells that are suspected to have been tampered with will not be sampled until the Project Geologist has discussed the matter with the PM.

Before the start of sampling activities, plastic sheeting will be placed on the ground adjacent to the well. The plastic sheeting will be used to provide a clean working area for clean equipment to be placed during sampling. Water will be removed from the protective casing or from vaults around the well casing prior to venting and purging. Every time a casing cap is removed to measure water level or collect a sample, the air in the breathing zone will be checked with an organic vapor monitor and the air in the well bore shall be checked with an explosimeter. Procedures in the HSP will be followed when high concentrations of organic vapors or explosive gases are detected. Air monitoring data will be recorded on the well sampling form.

Purge pump intakes will be equipped with a positive check valve to prevent purged water from flowing back into the well. Purging and sampling will be performed in a manner that minimizes aeration in the well bore and the agitation of sediments in the well and formation. Equipment will not be allowed to free-fall into a well.

In addition to the information required in Section 8.0, the following information will be recorded each time a well is purged and sampled: (1) depth to water before and after purging; (2) sounded total depth of the monitoring well; (3) the condition of each well, including visual (mirror) survey; (4) the thickness of any nonaqueous layer and; (5) field parameters, such as pH, temperature, electrical conductivity (EC), oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity. This information will be encoded in IRP Information Management System (IRPIMS) files when required.

### 6.1.1.1 Water Level Measurement

An interface probe will be used to determine the presence of floating product, if any, prior to measurement of the ground-water level. The ground-water level will then be measured to the nearest 0.01 foot using an electric water level indicator. Water levels will be measured from the notch located at the top of the well casing and recorded on the well sampling form. If well casings are not notched, measurements will be taken from the north edge of the top of the well casing, and a notch will be made using a decontaminated metal file. The groundwater elevation (mean sea level) is calculated by subtracting the depth to the water from the top of the well casing elevation.

Following water level measurement, the total depth of the well from the top of the casing will be determined using a weighted tape or electric sounder and recorded on the well sampling form. The water level depth will then be subtracted from the total depth of the well to determine the height of the water column present in the well casing. All water level and total depth measuring devices will be routinely checked with a tape measure to ensure measurements are accurate.

### 6.1.1.2 Purging Prior to Sampling

Purging of monitoring wells is performed to evacuate water that has been stagnant in the well and may not be representative of the aquifer. Purging will be accomplished using the micropurge technique. Micropurge is a low flow-rate monitoring well purging and sampling method that induces laminar (non turbulent) flow in the immediate vicinity of the sampling pump intake, thus drawing groundwater directly from the sampled aquifer, horizontally through the well screen, and into the sampling device.

Pumps capable of achieving low-flow rates in the range of 0.1-0.5 liters per minute (L/min) will be used for purging and sampling. These low flow rates minimize disturbance in the screened aquifer, resulting in the following: (1) minimal production of artificial turbidity and oxidation; (2) minimal mixing of chemically distinct zones; (3) minimal loss of volatile organic compounds; and (4) collection of representative samples while minimizing purge volume.

Pumps will be lowered to the middle of the screened interval or slightly above the interval (ie. a measured depth of 43 percent of the saturated screened interval below the top of the water table). This is to minimize the resuspension of solids which have collected at the bottom of the well and to minimize the potential mixing of stagnant water trapped in the casing above the screen. The key is to minimize the disturbance of water and solids in the well casing.

As a guide to flow rate adjustment during purging, water levels will be checked and recorded to monitor drawdown in the well. Groundwater will be pumped in a manner which minimizes the stress to the system to the extent practical, taking into account established site sampling objectives. The goal is to purge the well at a rate that does not draw down the static water level more than 0.33 feet.

Temperature, pH, EC, DO, ORP, and turbidity will also be measured during purging and recorded on the well sampling form. Measurements will be taken every three to five minutes

when flow rates are in the 0.1-0.5 L/min range. Stabilization is achieved after all parameters have stabilized for three consecutive readings. Successive readings should be approximately within  $\pm$  1.0 degrees Celsius (° C) for temperature,  $\pm$  0.1 units for pH,  $\pm$  3 percent for EC,  $\pm$  0.1 mg/L or 10 percent (whichever is greater) for DO,  $\pm$  10 percent for ORP, and  $\pm$ 10 % for turbidity. In general, the order of stabilization is pH, temperature, and EC, followed by ORP, DO, and turbidity. Turbidity readings below 10 NTUs are desired, especially when metal samples are to be collected. When turbidity is high, the purge time will be extended in order for turbidity to reach 10 NTUs; however, if turbidity stabilizes above 10 NTUs for 15-30 minutes, then turbidity will be considered stable as defined above.

Groundwater samples will be collected using the pump used in the purging procedure. If the parameters do not stabilize after one to two hours when the drawdown indicates a laminar flow, a subset (pH, EC, and turbidity or DO) will be used as the stabilization parameters. If subset parameters do not stabilize, then the sample will be collected when a maximum number of parameters stabilize, and the anomalous parameters will be brought to the Field Coordinator's attention. Water samples will be collected immediately after parameter stabilization using the same pump as was used in purging. Field equipment will be calibrated in accordance with the Basewide QAPP (HydroGeoLogic, 1998), Section 6.0, and in Section 7.2 of this FSP.

If during low-flow purging the drawdown is greater than 0.33 feet, then the micropurge technique is assumed to be invalid and will be discontinued. The reason is that groundwater flow to the pump is no longer considered to be laminar across the screen from the aquifer. The flow in the vicinity of the pump would then contain a vertical component from the stagnant water column in the filter pack and casing.

In this situation (ie. drawdown > 0.33 feet at low-flow rates), the pumping rate will be increased and a minimum of three borehole volumes will be removed to ensure that all of the stagnant water has been removed from the borehole. The drawdown will continue to be monitored and the pumping rate will be adjusted to avoid pumping the well dry. Measurements for water quality parameters will be taken every 3 to 5 minutes. After three well volumes have been removed water samples will be collected when the water level has recovered to 80 percent of its static water level or 16 hours after completion of purging. Water samples will be collected using either a low-flow pump or a Teflon bailer.

If a well is purged dry, then the well will be sampled as soon as a sufficient volume of groundwater has entered the well to enable the collection of necessary groundwater samples (EPA, 1992). Water samples will be collected using either a low-flow pump or a Teflon bailer.

Water removed from the well during purging will be containerized. Detailed information concerning IDW is presented in Section 5.9. A maximum of five well volumes may be removed from any well before it is sampled. The well volume is defined as the volume of submerged casing, screen, and filter pack. One borehole volume can be calculated using the following equation (Ohio EPA, 1993):

$$V = H \times F$$

where

V =one borehole volume

H =the difference between the depth of well and depth to water (feet)

F = factor for volume of one foot section of borehole (gallons) from Table 6.1

F can also be calculated from the formula:

$$F = \prod (D/2)^2 \times 7.48 \text{ gal/ft}$$

where D = the inside diameter of the borehole (feet) and  $\Pi$  = 3.141593.

### 6.1.1.3 Sample Collection

At newly developed wells, water samples may only be collected after a 24-hour period has elapsed from the conclusion of monitoring well development activities.

Following the micropurge techniques, or 3 well volume techniques outlined above, the bladder pump will be used to collect water samples. Samples to be analyzed for volatile or gaseous constituents will not be withdrawn with pumps or at flows that degas the samples. Water-quality indicators will be monitored during micropurge (turbidity, DO, specific conductance, temperature, etc.).

Groundwater samples will be collected after the critical water quality indicators have stabilized for three consecutive readings. Stabilization criteria are presented above in Section 6.1.1.2. Where possible, groundwater samples will be collected using the same pump used in the purging procedure. If the parameters do not stabilize, a subset (pH, EC, and turbidity or DO) will be used as the stabilization parameters. If subset parameters do not stabilize, then the sample shall be collected as described above in Section 6.1.1.2, and the anomalous parameters shall be brought to the Field Coordinator's attention. Field equipment will be calibrated in accordance with the base-wide QAPP (HydroGeoLogic, 1998).

The preservative hydrochloric acid shall be added to the VOC sample bottle before introducing the sample water. The sample shall be collected from the pump discharge line using a slow, controlled pour down the side of a tilted sample vial to minimize volatilization. The sample vial shall be filled until a meniscus is visible and immediately sealed. When the bottle is capped, it shall be inverted and gently tapped to ensure no air bubbles are present in the vial. If bubbles are present after the initial filling, the vials shall be discarded and the VOC sampling effort shall be repeated. Refilling of vials will result in loss of preservatives. After the containers are sealed, degassing may cause bubbles to form in the sample. These bubbles shall be left in the container. These samples shall never be composited, homogenized, or filtered.

Following the collection of VOC samples, the remaining water samples shall be collected in the following order: SVOCs including polynuclear aromatic hydrocarbons (PAHs); pesticides/PCBs; herbicides organophosphorus pesticides, dioxins/furans; metals; mercury; cyanide; sulfide; ferrous iron (Fe [II]); alkalinity; and common anions. Field filtering of metals will not occur.

Required sample containers, preservation methods, volumes and holding times are given in Section 6.2 and Table 6.2. Sampling equipment shall be decontaminated in accordance with Section 5.8 upon completion of sampling activities.

### 6.1.2 Surface Soil Sampling

Although surface soil sampling is not currently proposed, if field conditions warrant their collection the following procedures will be used.

Surface soil samples shall be collected from the land surface to two feet below the surface. The sample shall be homogenized and quartered before being containerized. Samples collected for VOC analysis shall be containerized in EnCore™ core samplers prior to sample homogenization. Stainless steel scoops or trowels, glass jars with Teflon® lids or equivalent equipment compatible with the chemical analyses proposed shall be used to collect and store samples. Above ground plant parts and debris will be excluded from the sample.

In addition to records outlined in Section 8.0, unusual surface conditions that may affect the chemical analyses will be recorded, such as (1) asphalt chunks that may have been shattered by mowers, thus spreading small fragments of asphalt over the sampling area, (2) distance to roadways, aircraft runways, or taxiways, (3) obvious, deposition of contaminated or clean soil at the site, (4) evidence of dumping or spillage of chemicals, (5) soil discoloration, and/or (6) unusual condition of growing plants, etc.

### 6.1.3 Subsurface Soil Sampling

Soil samples will be collected based on odors, discoloration and, organic vapor monitor readings. If no odors, discoloration or organic vapor readings are observed, subsurface samples will be collected directly above the water table surface.

During borehole installation using HSA and DPT methods, soil samples will be collected using steel, continuous drive, California modified split-spoon samplers, or equivalent. These samplers are typically 24 inches in length and accommodate four stainless steel/brass sleeves, each of which is 6 inches in length. Soil samples from selected locations will be collected for chemical analysis every 5 feet from the ground surface to the water table.

As soon as the split-spoon is opened, the open ends of the stainless steel/brass sleeves will be monitored for organic vapors using the PID. Air monitoring results will be recorded on the boring log and in the field log book. Section 7.1.1 details field screening procedures for soils.

Samples for VOC analysis will be collected as an entire 5 gram core using an En Core™ core sampler. En Core™ is a sampling device which collects, stores, and delivers soil samples. The sealing cap prevents transfer of volatiles, and is therefore ideal when collecting soil samples for VOC analysis. Three such cores will be collected from each VOC sampling location. Each core sampler will be completely filled to eliminate headspace. VOC samples from large gravel or debris will be collected using a 6-inch stainless steel/brass sleeve rather than an En Core™ core

sampler. Following sample collection, each sampler will be capped to prevent volatilization. Each core sampler is associated with a dedicated plastic/aluminum foil zip lock bag on which is affixed a sample label. The sample label will be completed, the unique identification number label (matching the number on the bag) will be affixed to the core sampler, and the sampler will be placed into the bag and placed in an iced cooler held at a temperature below 4°C.

Samples collected concurrently with VOC samples to be tested for other analytical parameters will be collected by extruding the soil out of the stainless steel/brass sleeves immediately adjacent to (above and below) the VOC sample interval. If VOCs are not collected while using DPT, acetate liners may be substituted for the stainless steel/brass sleeves. Soil chemistry samples not being analyzed for VOCs will be placed in 4-ounce, laboratory cleaned, EPA-approved glass containers with Teflon<sup>®</sup> lined lids. This will be done using clean stainless steel sampling tools. If soil from several stainless steel/brass rings must be composited to provide sufficient sample volume for a particular analysis (other than VOCs), the sample will be composited and homogenized in a stainless steel bowl using a stainless steel trowel or scoop. The sample will then be transferred into the appropriate sample container, sealed, labeled, and placed in an iced cooler held at a temperature below 4°C. If initial screening results indicate the presence of organic vapors, a headspace analysis will be conducted on remaining portions of the sample.

### 6.1.3.1 Hollow Stem Auger Sampling

For split-spoon samples collected using HSA, a standard penetration test will be performed in accordance with ASTM D-1586 "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils." The sample is obtained by driving the sampler a distance of 1 foot into undisturbed soil with a 140-pound hammer free falling a distance of 30 inches. The sampler is first driven 6 inches to seat it in undisturbed soil; then the test is performed. The number of hammer blows for seating the spoon and making the test are then recorded for each 6 inches of penetration on the drill log (i.e., 5/7/8). The standard penetration test result (N) is obtained by adding the last two figures (i.e., 7+8=15 blows per foot). The sampler is then driven an additional 6 inches to fill the remainder of the split-spoon prior to retrieval.

### 6.1.3.2 <u>Direct Push Sampling</u>

Direct push sampling involves advancing a sampling probe by direct hydraulic pressure or by using a slide or rotary hammer. Samples will be collected using stainless steel/brass sleeves or an En Core™ sampler as described in Section 6.1.3. Acetate liners may be used when collecting soil for non-VOC analysis in order to expedite the sampling process.

### 6.2 SAMPLE HANDLING

### **6.2.1** Sample Containers

Sample containers will be provided to field personnel, precleaned and treated according to EPA specifications for the methods. No sampling containers will be reused for the sampling events of

this RFI/SI. Containers will be stored in clean areas to prevent exposure to fuels, solvents, and other contaminants.

### 6.2.2 Sample Volumes, Container Types, and Preservation Requirements

Sample volumes, container types, and preservation requirements for the analytical methods performed on AFCEE samples are listed in Table 6.2. The pH of preserved samples will be checked by the laboratory prior to analysis. Sample holding time tracking begins with the collection of samples and continues until the analysis is complete. Holding times for methods used in this FSP are specified in Table 6.2.

### **6.2.3** Sample Identification

The following information will be written in the log book and on the sample label when samples are collected for laboratory analysis:

- Project identification (name and number)
- Sample identification number
- Sample location
- Preservatives added
- Date and time of collection
- Requested analytical methods
- Sampler's name

Each sample will be assigned a unique identification number that describes where and what type of sample was collected. The number that will be used in the field will consist of a maximum 15 digit alphanumeric code. Once data is ready to be entered into the IRPIMS database, the alphanumeric code will be truncated to 15 digits. This system is explained in detail as follows:

### abbbccccdd-ee

### where:

- a represents the medium (e.g., W=monitoring well, B = soil boring, or E = sediment sample).
- bbb represents HydroGeoLogic designation (e.g. HGL)
- ccccc represents the SWMU/AOC number (e.g., SWMU 19, SWMU 53, AOC 17, etc.)
- dd represents the location identification (Locid) (e.g., 01, 02)
- represents the order that the sample was obtained within the soil boring; i.e., a surface soil sample would be 01, a 5- to 7-foot sample would be 02, etc. These two digits will dropped once the data is entered into the IRPIMS database.

For example, the first soil sample collected from soil boring 01 located at SWMU 53 would be identified as "BHGLSWMU5301-01." The second sample collected from soil boring 01 located at SWMU 53 would be identified as "BHGLSWMU5301-02". Duplicate samples will be submitted to the laboratory blind. A note in the field log book and the Field Sampling Report form will identify the location and sample number that has been duplicated.

QC samples will be identified by the use of a similar system of identifiers with a maximum of 10 characters. The QC sampling number system is summarized below.

### aabbccdd

### where:

```
aa represents medium (e.g. ER = equipment rinsate, TB = trip blank, AB = ambient blank, EB = equipment blank)
```

```
bb represents the month, e.g. 06 cc represents the day, e.g. 15
```

dd represents the year, e.g. 00

For example, an equipment blank collected on the 15th day of June in the year 2000 will be "EB061500."

The Project Geologist will maintain a list that describes how each QC sample corresponds with specific environmental samples. For instance, each trip blank will be correlated with a particular set of samples shipped to the laboratory, and each rinsate will be correlated to those samples collected by a particular set of decontaminated sampling tools.

### 6.3 SAMPLE CUSTODY

Procedures to ensure the custody and integrity of the samples begin at the time of sampling and continue through transport, sample receipt, preparation, analysis and storage, data generation and reporting, and sample disposal. Records concerning the custody and condition of the samples are maintained in field and laboratory records.

COC records will be maintained for all field and field QC samples. A sample is defined as being under a person's custody if any of the following conditions exist: (1) it is in their possession, (2) it is in their view, after being in their possession, (3) it was in their possession, and they locked it up, or (4) it is in a designated secure area. All sample containers will be sealed in a manner that will prevent or detect tampering if it occurs. In no instance will tape be used to seal sample containers. Samples will not be packaged with activated carbon. Appendix D in the WP contains a sample COC form.

The following minimum information concerning the sample will be documented on the COC form:

- Unique sample identification
- Date and time of sample collection
- Source of sample (including name, location, and sample type)
- Designation of Matrix Spike/Matrix Spike Duplicate (MS/MSD)
- Preservative used
- Analyses required
- Name of collector(s)
- Serial numbers of custody seals and transportation cases (if used)
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories
- Bill of lading or transporter tracking number (if applicable)

All samples will be uniquely identified, labeled, and documented in the field at the time of collection in accordance with Section 6.2.3 of the FSP. Samples collected in the field will be transported to the laboratory or field testing site as expeditiously as possible. When a 4°C requirement for preserving the sample is indicated, the samples will be packed in ice or chemical refrigerant to keep them cool during collection and transportation. During transit, it is not always possible to rigorously control the temperature of the samples. As a general rule, storage at low temperature is the best way to preserve most samples. A temperature blank (a VOC sampling vial filled with water) will be included in every cooler and used to determine the internal temperature of the cooler upon receipt of the cooler at the laboratory.

### 6.4 FIELD QUALITY CONTROL SAMPLES

Field quality control samples such as blanks and duplicates will be collected as described in the following sections.

### 6.4.1 Ambient Blank

The ambient blank consists of ASTM Type II reagent-grade water poured into a VOC sample vial at the sampling site. It is handled like an environmental sample and transported to the laboratory for analysis. Ambient blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes.

Ambient blanks are used to assess the potential introduction of contaminants from ambient sources (e.g., active runways, engine test cells, gasoline motors in operation, etc.) to the samples during sample collection. Ambient blanks will be collected downwind of possible VOC sources. One ambient blank will be collected at the beginning of the field investigation. Additional ambient blanks will be collected if site conditions warrant.

### 6.4.2 Equipment Blank

An equipment blank is a sample of ASTM Type II reagent-grade water poured into, over, or pumped through the sampling device, collected in a sample container, and transported to the laboratory for analysis. Equipment blanks are used to assess the effectiveness of equipment decontamination procedures. Equipment blanks will be collected immediately after the equipment has been decontaminated. The blank will be analyzed for all laboratory analyses requested for the environmental samples collected at the site. One equipment blank will be collected per day when environmental samples are collected.

### 6.4.3 Trip Blank

The trip blank consists of a VOC sample vial filled in the laboratory with ASTM Type II reagent-grade water, transported to the sampling site, handled like an environmental sample, and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are prepared only when VOC samples are taken and are analyzed only for VOC analytes. Trip blanks are used to assess the potential introduction of contaminants from sample containers or during the transportation and storage procedures. One trip blank will accompany each cooler of samples sent to the laboratory for analysis of VOCs.

### 6.4.4 Field Duplicates

A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously, or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned an identification number in the field so that they cannot be identified (blind duplicate) as duplicate samples by laboratory personnel performing the analysis. Specific locations are designated for collection of field duplicate samples prior to the beginning of sample collection.

Duplicate sample results are used to assess precision of the sample collection process. Precision of soil samples to be analyzed for VOCs is assessed from collocated samples because the compositing process required to obtain uniform samples could result in loss of the compounds of interest. One duplicate sample will be collected for every ten groundwater samples collected.

### 7.0 FIELD MEASUREMENTS

### 7.1 PARAMETERS

### 7.1.1 Field Screening of Soils

RFI/SI field activities will utilize field screening of soil samples for VOCs to provide data on the chemical characteristics of the soil at the sites. During hand auguring and HSA drilling activities, sample cores will be monitored for organic vapors using an OVA or PID, and headspace readings will be recorded from collected soils. Headspace analysis will be performed on each lithologic and analytical soil sample collected. A portion of the recovered soil sample will be placed into a quart-size, resealable plastic bag, and the bag will be labeled, sealed, and shaken to mix the sample. The sample will be allowed to volatilize in a shaded area for approximately 15 minutes after which a headspace reading will be taken by punching through the bag with an OVA or PID sampling tip. The OVA or PID shall be calibrated using a standard of known concentration (e.g., isobutylene at 100 parts per million) in accordance with the requirements of the Final Basewide QAPP (HydroGeoLogic, 1998). The sampling tip will not be placed in the soil, but in the headspace of the bag. A background headspace value will be obtained from empty reseal able plastic bags handled in a manner identical to the plastic bag containing the headspace sample. The headspace reading and the background reading will be recorded on the Soil Boring Log (located in Appendix D of the work plan).

### 7.1.2 Field Parameters for Water Samples

The pH will be measured during groundwater purging using a portable pH meter. The pH meter will be calibrated with three buffer solutions of the appropriate range for the expected values of pH. The meter will be recalibrated daily.

### 7.2 EQUIPMENT CALIBRATION AND QUALITY CONTROL

Field equipment will be maintained and calibrated to the standards in their respective operations manuals. Equipment failures will be repaired in the field if possible; if not, the instrument will be tagged, removed from use, and returned for repair or replacement. Field equipment will be calibrated daily before the start of sampling activities. Calibration records will be maintained on the Calibration Log (Appendix D of the WP). The calibration record will include a unique instrument number (e.g., serial number), standards used, concentrations, and meter readings.

### 7.3 EQUIPMENT MAINTENANCE AND DECONTAMINATION

### 7.3.1 Equipment Maintenance

Field equipment will be kept in a controlled storage room and will be decontaminated prior to return to storage; any malfunctions will be reported to the Project Geologist. The Field Coordinator will initiate actions necessary for the repair or replacement of defective equipment.

Equipment maintenance logs are kept updated and on file. Power supplies of battery-powered instruments will be checked daily. Rechargeable instruments will be recharged daily.

### 7.3.2 Decontamination of Field Instruments

Decontamination of field instruments will be instrument-specific. The probes of the pH meters will be rinsed with reagent-grade water before and after each use, and at the end of each day. No decontamination is required for the OVA.

### 7.4 FIELD PERFORMANCE AND SYSTEM AUDITS

The Project Geologist or a designated representative will conduct weekly informal audits of the field activities. The weekly audit for completeness will include the following items:

- Sample labels
- COC records
- Field notebooks
- Sampling operations
- Document control

The first three items above will be checked for completeness. Sampling operations will be reviewed to determine if they are performed as stated in the WP or as directed by the Project Geologist. The informal document control audit will consist of checking each document for completeness, including items such as signatures, dates, and project numbers.

An unscheduled systems audit of field operations will be conducted using the project-specific WP and will be used to review the total data generation. The audit will include on-site review of the field operational system, physical facilities for sampling, and equipment calibrations. A performance audit may be conducted by the PM and Project Geologist if deemed necessary by the PM, Project Geologist, Lab Coordinator, or Client. The audit may focus on verifying that proper procedures are being followed so that subsequent sample data will be valid. Prior to the audit, a checklist will be prepared by the PM and Project Geologist that will serve as a guide for the performance audit.

The audit will verify whether or not the following items are being accomplished: (1) collection of samples follows the available written procedures, (2) COC procedures are followed for traceability of samples origin, (3) appropriate QC checks are being made in the field and documented in the field log book, (4) specified equipment is available, calibrated, and working properly, (5) sampling crews are adequately trained, (6) record-keeping procedures are being followed and appropriate documentation is maintained, and (7) corrective action procedures are followed. An audit report summarizing the results and corrections will be prepared and filed in the project files.

### 8.0 RECORD KEEPING

HydroGeoLogic will maintain field records sufficient to recreate all sampling and measurement activities and to meet all IRPIMS data loading requirements. The information shall be recorded with indelible ink in a permanently bound notebook with sequentially numbered pages. These records shall be archived in an easily accessible form and made available to the USAF upon request.

The following information will be recorded for all field activities: (1) location, (2) date and time, (3) identity of people performing activity, and (4) weather conditions. The following information will be recorded for all field measurements: (1) the numerical value and units of each measurement, and (2) the identity of and calibration results for each field instrument will also be recorded.

The following additional information will be recorded for all sampling activities: (1) sample type and sampling method, (2) the identity of each sample and depth(s), where applicable, from which it was collected, (3) the amount of each sample, (4) sample description (e.g., color, odor, clarity), (5) identification of sampling devices, and (6) identification of conditions that might affect the representativeness of a sample (e.g., refueling operations, damaged casing).

The following section describes the field documentation procedures, which will be followed as a means of recording observations and findings during the RFI/SI field investigation. Documentation will include the form of field log books, various sample and calibration forms, site photographs, and drawings/sketches. All documentation will be completed in indelible ink and corrections will be stricken out with a single line and initialed. Examples of field forms are included in Appendix D of the WP.

### 8.1 FIELD LOG BOOK

Log books with sequentially numbered pages will be kept at the site during all field activities and will be assigned to each sample team. These logs will be updated, continually, and will constitute master field investigation documents. Information to be recorded in the logs includes, but is not limited to, the following:

- Project identification
- Field activity subject
- General work activity, work dates, and general time of occurrence
- Unusual events
- Subcontractor progress or problems
- Communication with the client or others
- Weather conditions
- HydroGeoLogic personnel, subcontractors, and visitors on site
- Sample number and time of day for each sample collected for analysis
- Listing by sample number of samples collected during the day, sorted by COC record number (compiled at the end of the day)

- Record of telephone call to laboratory informing it of sample shipment
- Accomplishment of decontamination of drilling rig, construction materials, and sampling equipment
- Accomplishment of required calibration checks
- Disposition of purge water, decontamination fluids, and soil cuttings
- Variances from project plans and procedures (details will be recorded in the log book and presented in the RFI/SI)
- Accomplishment of tailgate safety meetings
- Review of project procedures with site personnel
- Head space screening and breathing zone readings
- Accomplishment of decontamination of water sampling equipment
- Photographs taken and identification numbers
- Name and signature of person making log book entries
- Inspections and results of inspections.

### 8.2 FIELD EQUIPMENT LOG BOOK

A field equipment log book will be kept on site to document the proper use, maintenance, and calibration of field testing equipment. Accompanying the field equipment log book will be a three-ring binder containing operator manuals, specifications, and calibration requirements and procedures for all field testing equipment. Information to be recorded in the field equipment log book includes the following:

- Equipment calibration status
- Equipment decontamination status
- Equipment nonconformance
- Equipment inspection and repair records
- Name and signature of person making entry
- Date of entry
- Name of equipment and its identifying number
- Nature of work conducted
- List or reference of procedures used for calibration or maintenance
- Manufacturer, lot number, and expiration date of calibration standards
- Measurement results.

### 8.2.1 Sample Collection Log

A sample collection log form (i.e., Field Sampling Report) will be completed for each sample collected during the investigation. An example of the Field Sampling Report Form is included in Appendix D of the WP. Information to be included on the form includes the following:

- Date and time of sample collection
- Sample location
- Sample type (i.e., surface soil, sediment, groundwater, etc.)
- Name of person collecting samples
- Sample volumes and container types.

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# TAB

Tables

Table 3.1
Data Quality Levels and Intended Use for Field and Laboratory Data

Sampling Matrix	Parameters <sup>a</sup>	Analytical Method	Field/Lab Analysis	Data Quality Level	Intended Use
Surface Soil Subsurface Soil	VOCs	PID PID	Field Field	Screening	Field screening for selecting samples for lab analysis
					To differentiate the stratigraphy, to identify buried waste
Soil	Trace Elements (metals) Mercury Organochlorine Pesticides and PCBs Organophoshorus Pesticides Chlorinated Herbicides VOCs	6010B/7000 7470A/7471 8080A 8140 8150 8260B	Lab Lab Lab Lab Lab Lab	Definitive Definitive Definitive Definitive Definitive Definitive	Nature/extent of contaminants, risk assessment, corrective measures study
	SVOCs Dioxins and Furans Cyanide Sulfide	8270C 8290 9010A/9012 9030	Lab Lab Lab Lab	Definitive Definitive Definitive Definitive	
Groundwater	Trace Elements (metals)/ Mercury VOCs SVOCs	6010B/7000 7470A/7471A 8260B 8270C	Lab Lab Lab Lab	Definitive Definitive Definitive Definitive	Nature/extent of contaminants, risk assessment, corrective measures study

VOCs - Volatile Organic Compounds
 SVOCs - Semivolatile Organic Compounds

PCBs - Polychlorinated Biphenyls

Table 3.2
Current SWMU and AOC Summary Table
NAS Fort Worth JRB, Texas

SWMU/	Description	Waste Managed	Operational Period	Status
ire T	Fire Training Area No. 2	Waste oils, recovered fuels, spent solvents and cleaners	1963-1993	Dumpsters removed from the inner bermed area in 1993. Site no longer in use.
Š	8,500-Gallon AST	Waste fuels and possibly solvents	1963-1993	AST and associated piping removed in 1993. Site no longer in use.
7,0	12,000-Gallon UST	Waste oils and solvents	1963-1993	UST reported to have been removed prior to 1993. Site no longer in use.
ys!	Storm Water Drainage System	JP-4, solvents, waste water, aucraft soaps	Approx. 1942- Present	Approx. 700 cubic feet of soil removed from the drainage ditch in 1993 Concrete liner installed along the entire length of the SWMU.
l S	Suspected Landfill Location	Construction debris, waste paints, waste thinners, solvents, waste oils, and PD-680*	1942-1944	Suspected former landfill filled in and covered by an asphalt parking lot.
ដូ ម៉ូ	Suspected Fire Training Area A	Waste oils, recovered fuels, spent solvents and cleaners*	1950-1953	Suspected former fire training area covered with an asphalt parking lot.
us Tre	Suspected Fire Training Area B	Waste oils, recovered fuels, spent solvents and cleaners*	1954-1962	Suspected former fire training area filled in and covered with vegetation.

The wastes reported in Table 3 2 are based on the general disposal practices of the former The actual waste handled at these sites is unknown. CAFB during the time the site was in operation. \*Note:

CH2M HILL, 1984, Installation Restoration Program Records Search for Carswell Air Force Base, Texas A.T. Kearney 1989, RCRA Facility Assessment, Carswell Air Force Base, Fort Worth, Texas Sources:

Table 3.3
Field Activities Summary
NAS Fort Worth JRB, Texas

Site	DPT Borings (to top of water table)	HSA Borings (to bedrock)	Borings (total)	Wells
SWMUs 19,20,21	16	2	18	2
SWMU 53	19	1	19	1
AOC 17	7	0	7	0
AOC 18	4	0	4	0
AOC 19	4	0	4	0
Total	50	3	52	3

Notes:

DPT = direct push technology HSA = hollow stem auger

Table 3.4 Soil Sample Analysis Summary NAS Fort Worth JRB, Texas

		_						_												
Total No. of Samples	86	25	92	62	102	96	96	96	38	35	35	35	35	35	35	35	35	35	24	22
No. of MS/MSD	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
No. of Field Duplicates	7	7	7	7	7	7	L	<i>L</i>	ε	ε	ε	ε	ε	ε	ε	ε	ε	ε	2	2
No. of Trip Blanks	5	0	0	0	5	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0
No. of Ambient Blanks	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
No. of Equipment Blanks !	5	5	5	5	5	5	5	5	2	2	2	2	2	2	2	2	2	2	2	2
No. of Samples <sup>1</sup>	72	72	72	72	9/	9/	92	92	20	20	20	20	20	20	20	20	20	20	16	16
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Method	SW8260B	SW8270C	SW6010B	SW7471A	SW8260B	SW8270C	SW6010B	SW7471A	SW8260B	SW8270C	SW8080A	SW8141A	SW8151A	SW8280A	SW9012A	SW9030A	SW6010B	SW7471A	SW8260B	SW8270C
ONE STATE OF THE S	SWMUs 19, 20, 21				SWMU 53				A0C 17										AOC 18	

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### Soil Sample Analysis Summary NAS Fort Worth JRB, Texas Table 3.4 (continued)

				No. of	No. of	No. of			Total
Site	Method	Matrix	No. of Samples 1	Equipment Blanks <sup>2</sup>	Ambient Blanks <sup>3</sup>	Trip Blanks	No. of Field Duplicates 5	No. of MS/MSD <sup>6</sup>	No. of Samples
AOC 18	SW6010B	Soil	16	2	0	0	2	1/1	22
(cont'd)	SW7471A	Soil	16	2	0	0	2	1/1	22
AOC 19	SW8260B	Soil	16	1	1	1	1	1/1	20
	SW8270C	Soil	16	1	0	0	1	1/1	-20
	SW6010B	Soil	16	1	0	0	1	1/1	20
	SW7471A	Soil	16	1	0	0	1	1/1	20

samples The actual number of soil samples collected will vary depending on the actual depth to groundwater
Sites where only one boning will be sampled will be paired with a QC sample from another boring. One equipment blank will be taken per day, per analysis (for example, 3 equipment blanks represents 1 sample/day for 3 The number of soil samples is based on the estimated average depth to groundwater Three borings with 4 samples each will yield 12 Soil samples must be collected every 5 feet from the surface to the groundwater

Distribute blanks for VOCs will only be sampled if VOCs are detected by the PID during a sampling effort. One ambient blank will be collected at the beginning of the field investigation for soil One trip blank will be included per cooler when at least one sample is analyzed for VOCs from that cooler. Field duplicates collected on a 10% basis of investigation samples MS/MSDs collected on a 5% basis of investigation samples.

Table 3.5
Groundwater Sample Analysis Summary
NAS Fort Worth JRB, Texas

		_				_				_	_	_	_	_						=
Total No. of Samples	6	7	7	7	10	8	80	80	10	8	8	80	8	8	8	8	8	8	0	0
No. of MS/M SD'	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	0	0
No. of Field Duplicates	1	1	1	1	1	1	1	1	1	1	1	ī	1	1	1	1	1	1	0	0
No. of Trip Blanks <sup>5</sup>	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
No. of Ambient Blanks	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
No. of Equipment Blanks	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		0	0
No. of Samples!	5	5	5	5	9	9	9	9	4	4	4	4	4	4	4	4	4	4	0	0
Mairix	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Wethod	SW8260B	SW8270C	SW6010B	SW7470A	SW8260B	SW8270C	SW6010B	SW7470A	SW8260B	SW8270C	SW8080A	SW8141A	SW8151A	SW8280A	SW9012A	SW9030A	SW6010B	SW7470A	SW8260B	SW8270C
Site	SWMU 19, 20, 21				SWMU 53				AOC 17										AOC 18	

## **Groundwater Sample Analysis Summary** NAS Fort Worth JRB, Texas Table 3.5 (continued)

				No. of	No. of	No. of	Jo oN	No. of	Total
			No. of	Equipment	Ambient	Trip	Field	MS/M	No. of
Site	Method	Matrix	Samples <sup>1</sup>	Blanks	Blanks <sup>4</sup>	Blanks <sup>5</sup>	Duplicates <sup>6</sup>	SD'	Samples <sup>2</sup>
AOC 18	SW6010B	Groundwater	0	0	0	0	0	0	0
(cont'd)	SW7470A	Groundwater	0	0	0	0	0	0	0
AOC 19	SW8260B	Groundwater	1	1	1	1	1	2	7
	SW8270C	Groundwater	1	1	0	0	1	2	4
	SW8080A	Groundwater	1	1	0	0	1	2	4
	SW8141A	Groundwater	1	1	0	0	1	2	4
	SW8151A	Groundwater	1	1	0	0	1	2	4
	SW8290A	Groundwater	1	1	0	0	1	2	4
	SW9012A	Groundwater	1	1	0	0	1	2	4
	SW9030A	Groundwater	1	1	0	0	1	2	4
	SW6010B	Groundwater	1	1	0	0	1	2	4
	SW7470A	Groundwater	1	1	0	0	1	2	4

Monitoring well to be sampled for three consecutive rounds 2 months apart

The number of samples is based on the number of samples collected during each sampling event, and on the assumption that there will be enough water in each well to purge and sample. The actual number of groundwater samples collected may vary depending on seasonal groundwater fluctuations

Field duplicates will be collected on a 10% basis of investigation samples MS/MSDs will be collected on a 5% basis of investigation samples

Table 4.1 Key Project Personnel

Name	Title	Organization	Telephone
Don Ficklen	Team Chief	AFCEE/ERD	(210) 536-5290
Michael Dodyk	NAS Fort Worth JRB POC	AFCEE/ERD	(817) 732-9734
Jım Costello	Program Manager	HydroGeoLogic	(703) 478-5186
Lynn Morgan	Project Manager	HydroGeoLogic	(703) 736-4518
Jan Kool	QA Manager	HydroGeoLogic	(703) 478-5186
Ken Rapuano	Health & Safety Officer	HydroGeoLogic	(703) 478-5186
TBD	Lab Project Manager	TBD	TBD
TBD	Lab Operations Manager	TBD	TBD
TBD	Lab QA Officer	TBD	TBD
TBD	Lab Sample Custodian	TBD	TBD
Brad Nielsen	Project Geologist	HydroGeoLogic	(512) 336-1170
Robert Wallace	Project Geologist	HydroGeoLogic	(703) 478-5186
Omar Abdi	Data Mgmt. Supervisor	HydroGeoLogic	(703) 478-5186
Bruce Rappaport	Senior Reviewer	HydroGeoLogic	(703) 478-5186
Todd Harrah	Senior Reviewer	HydroGeoLogic	(512) 336-1170

TBD - To Be Determined

## Table 5.1 Field Corrective Action Procedures NAS Fort Worth JRB, Texas

			Field	
Situation	Calibration	Frequency	Objective Affected	Corrective Action Procedure
Equipment malfunction			Equipment is calibrated and	- Notification of site supervisory personnel
PID/OVA	- Calibrated to ±20% of known calibration gas	- Daily	operating properly	- Correct problem, recalibrate
рН	- Calibrated with two buffer solutions that bracket expected sample pH	- Daily		- Repair or replace malfunctioning parts
SC	- Calibrated with two standards in expected range of sample SC	- Daily		- Recalibrate and/or replace standards
Temperature	- Calibrate within expected temperature range of samples	- Monthly		- Repair or replace malfunctioning parts
Turbidity	- Calibrate within expected range of sample turbidity	- Daily		- Submission of document to Project Geologist, Project Manager, and Quality Assurance Manager
Incorrect sample collection procedures	NA	NA	Samples are taken according to standard operating procedures	<ul> <li>Notification of site supervisory personnel</li> <li>Review of situation and correct procedures</li> <li>Submission of document to Project Geologist, Project Manager, and Quality Assurance Manager</li> </ul>

## Table 5.1 (continued) Field Corrective Action Procedures NAS Fort Worth JRB, Texas

Situation	Calibration	Frequency	Field Objective Affected	Corrective Action Procedure
Insufficient sample volume collection	NA	NA	Sufficient sample volume is provided to maintain sample integrity so that all required analyses can be conducted	<ul> <li>Notification of site supervisory personnel by laboratory manager</li> <li>Review site affected and impact of samples on site characterization - correct procedures</li> <li>Submission of document to Project Geologist, Project Manager, and Quality Assurance Manager</li> </ul>
Incorrect measurement data collection	NA	NA	Measurements are conducted according to standard operating procedures	<ul> <li>Notification of site supervisory personnel</li> <li>Review of situation and correct procedures</li> <li>Submission of document to Project Geologist, Project Manager, and Quality Assurance Management</li> </ul>

NA = Not Applicable

PID = Photoionization detect or/organic vapor analyzer

SC = Specific conductivity

Table 6.1
Volume of Water in One-Foot Section of Well Casing

Diameter of Borehole (inches)	F Factor (gallons)
1.5	0.09
2	0 16
3	0.37
4	0.65
6	1.47
8	2.60
10	4.04
12	5.81

Table 6.2
Requirements for Containers, Preservation Techniques,
Sample Volumes, and Holding Times

				Minimum	
Name	Analytical Methods	Container*	Preservation*.c	Sample Volume or Weight	Maximum Holding Time
Metals (except mercury)	SW6010A SW6020 and SW-846 AA methods	P, G, T	HNO <sub>3</sub> to pH < 2, 4°C	500 mL or 8 ounces	180 days (water and soil)
Mercury	SW7470 SW7471	P, G, T	$HNO_3$ to $pH < 2, 4^{\circ}C$	500 mL or 8 ounces	28 days (water and soil)
Chlorinated herbicides	SW8150B SW8151	G, Teflon- lined cap, T	4°C, pH 5−9	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Cyanide, total and amenable to chlorination	SW9010A SW9012	P, G, T	4°C; NaOH to pH > 12; 0.6g ascorbic acid	500 mL or 4 ounces	14 days (water and soil)
Dioxins and furans	SW8290	G, Teflon- lined cap, T	$4^{\circ}$ C, 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> (Kept Dark)	1 liter or 8 ounces	30 days to extraction and 45 days after extraction (water and soil)
Organochlorin e pesticides and polychlormate d biphenyls (PCBs)	SW8080A, SW8081,	G, Teflon- lined cap, T	4°C, pH 5−9	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Organo- phosphorus Pesticides	SW8140	G, Teflon- lined cap, T	4°C, pH 5-9	l liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Sulfide	SW9030	P, G, T	4°C; NaOH to pH > 9, 2ml zinc acetate	500ml or 4 ounces	7 days
Total Organic Carbon	SW9060	one 250 m/L polyethylene	$4^{\circ}$ C, $H_2$ SO <sub>4</sub> to $pH < 2$	250 m/L	28 days
Methane	SW3810 Mod.	3 40 mL clear glass vials with rubber septa & Teflon lined caps	4°C	120mL	14 days
Ferrous Iron	HACH method #8146	100-ml glass vials	NA	NA	Field method- analyze immediately
Alkalinity	E310.1	One 500-mL polyethylene	4°C	250mL	14 days

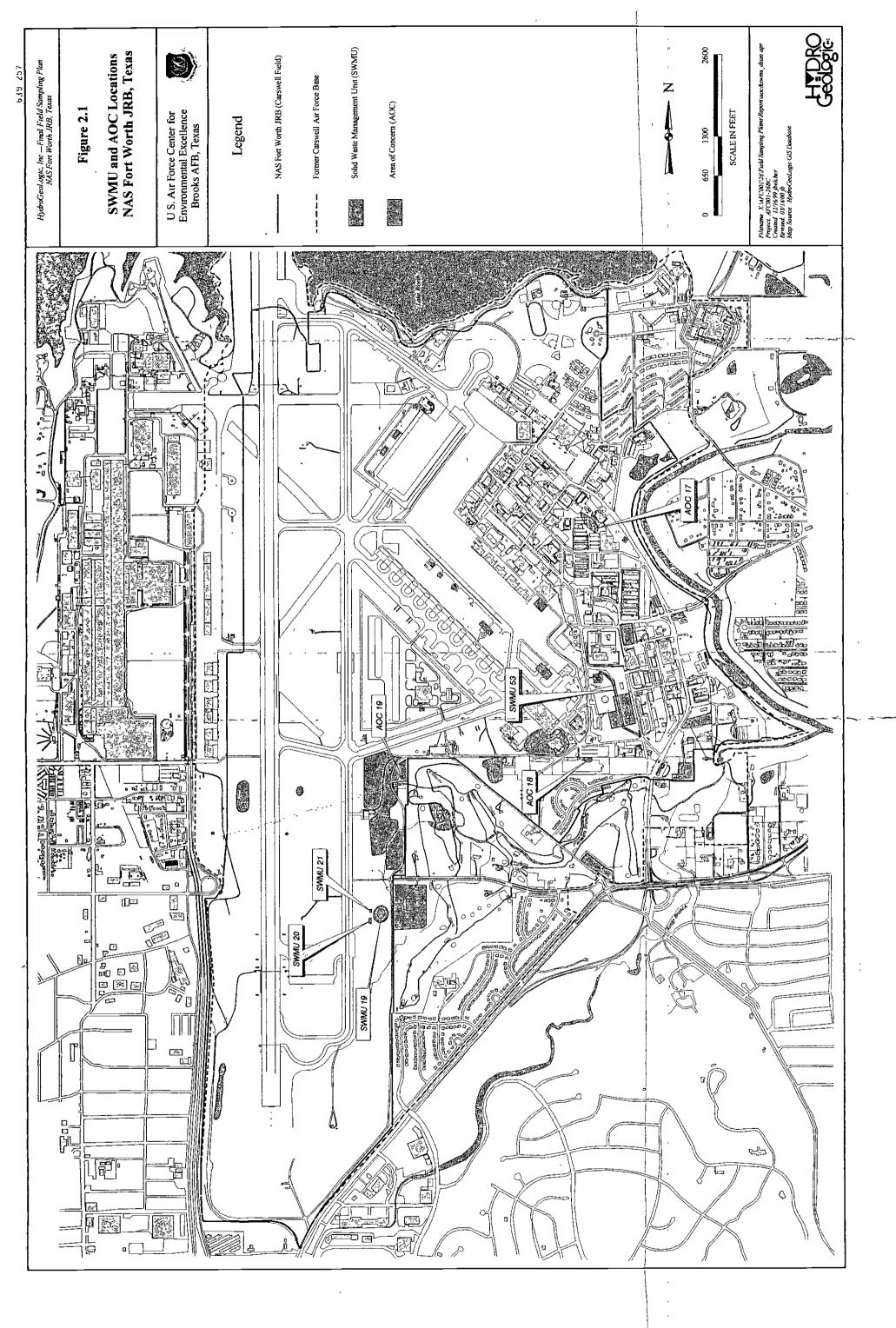
#### Table 6.2 (continued) Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

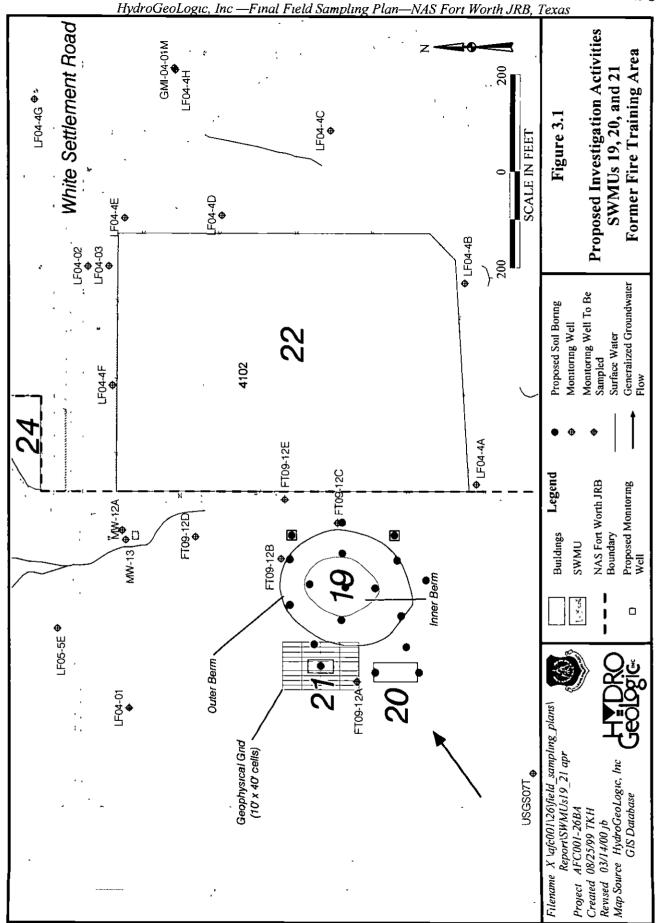
Name	Analytical Methods	Container*	Preservation <sup>b,c</sup>	Minimum Sample Volume or Weight	Maximum Holding Time
Common Anions	SW9056	one 1-L polyethylene	4°C	100mL	28 days for Br, F, Cl and SO <sub>4</sub> . <sup>2</sup> : 48 hours for NO <sub>3</sub> , NO <sub>2</sub> , and PO <sub>4</sub> . <sup>3</sup>
Semivolatile organics	SW8270B SW8310	G, Teflon- lined cap, T	4°C, 0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	1 liter or 8 ounces	7 days until extraction and 40 days after extraction (water); 14 days until extraction and 40 days after extraction (soil)
Volatile organics (water)	SW8260B	G, Teflon- lined septum	$4^{\circ}$ C, 0.008% $Na_2S_2O_3$ (HCl to pH < 2 for volatile aromatics by $SW8260)^b$	2 x 40 mL or 4 ounces	14 days; 7 days if unpreserved by acid
Volatile organics (soil)	SW8260B/ SW5035	EnCore™ Sampler	4°C, frozen at - 12 °C within 2 days of collection	3 x 5 gram cores	14 days

Polyethylene (P); glass (G), brass sleeves in the sample barrel, sometimes called California brass (T) No pH adjustment for soil. Preservation with 0.008 percent  $Na_2S_2O_3$  or by ascorbic acid is only required when residual chlorine is present.

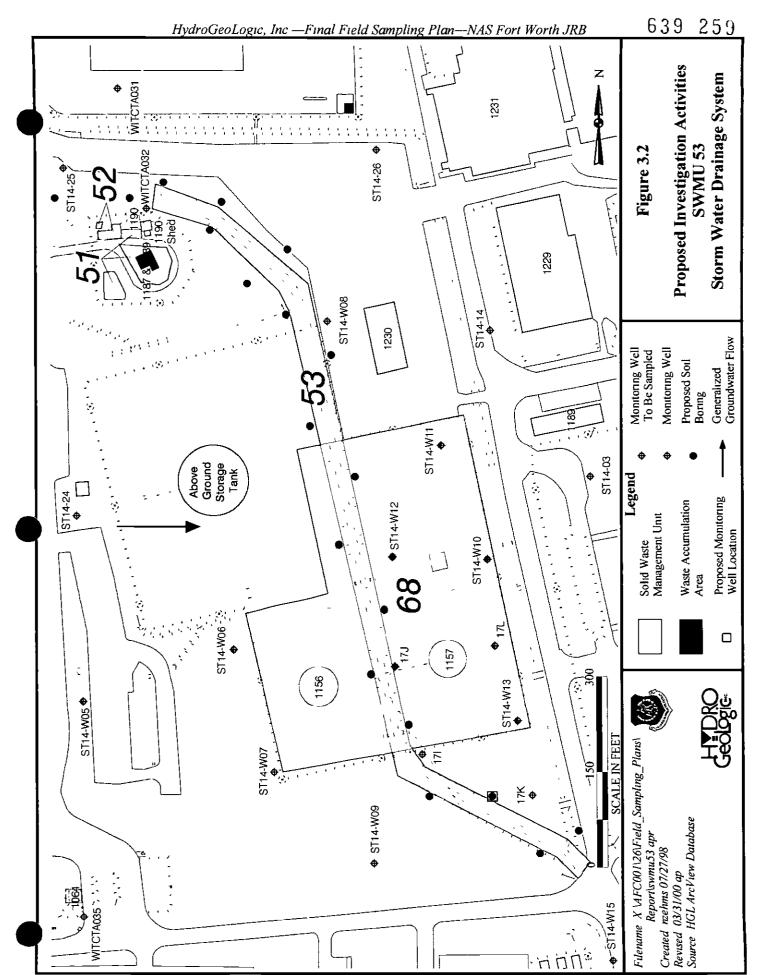
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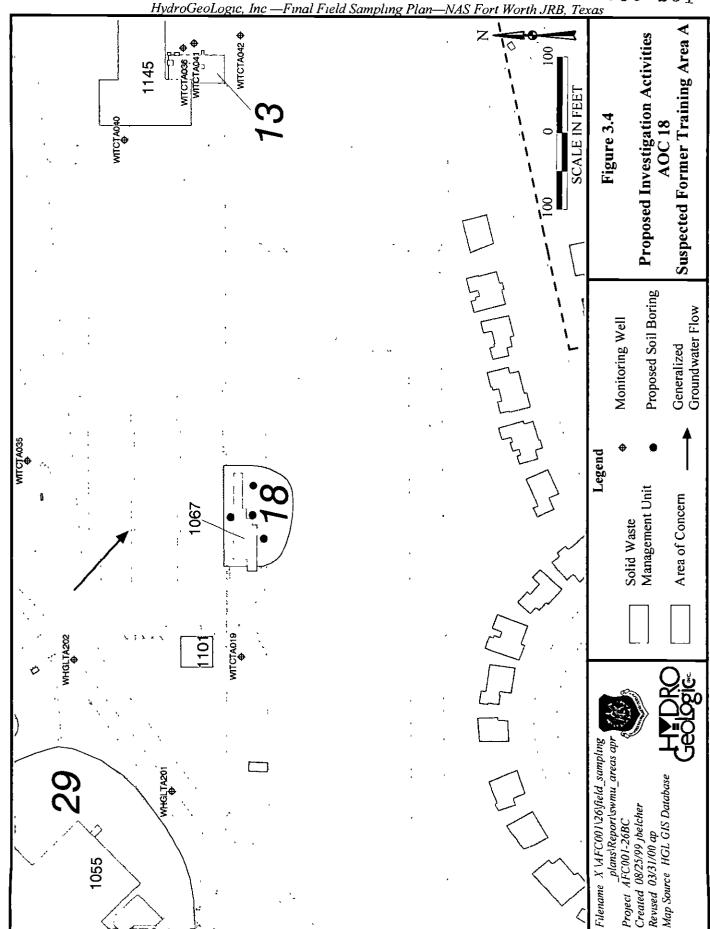


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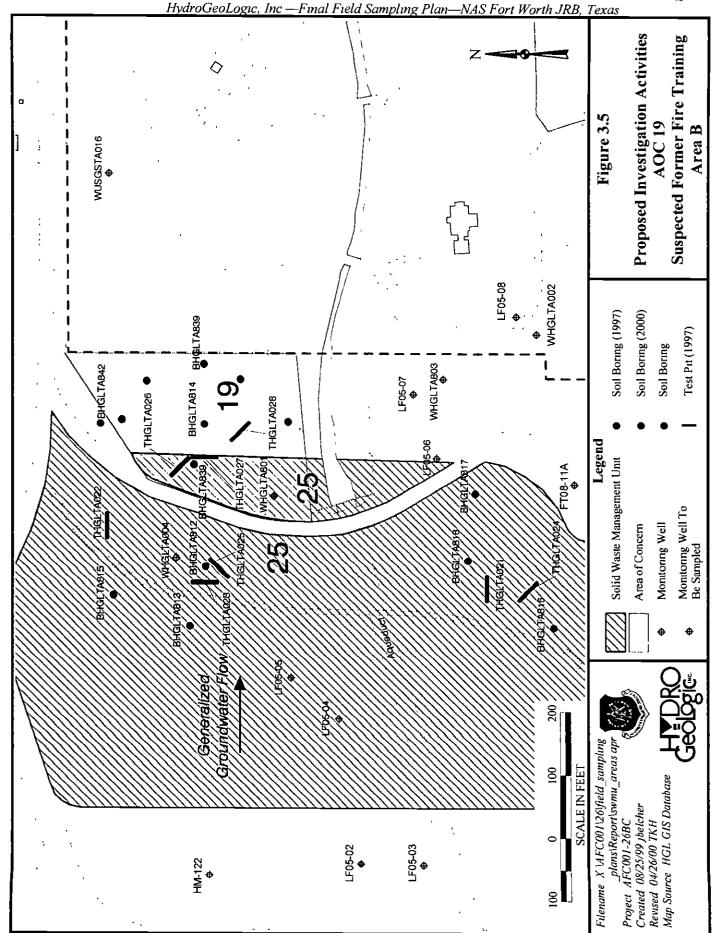


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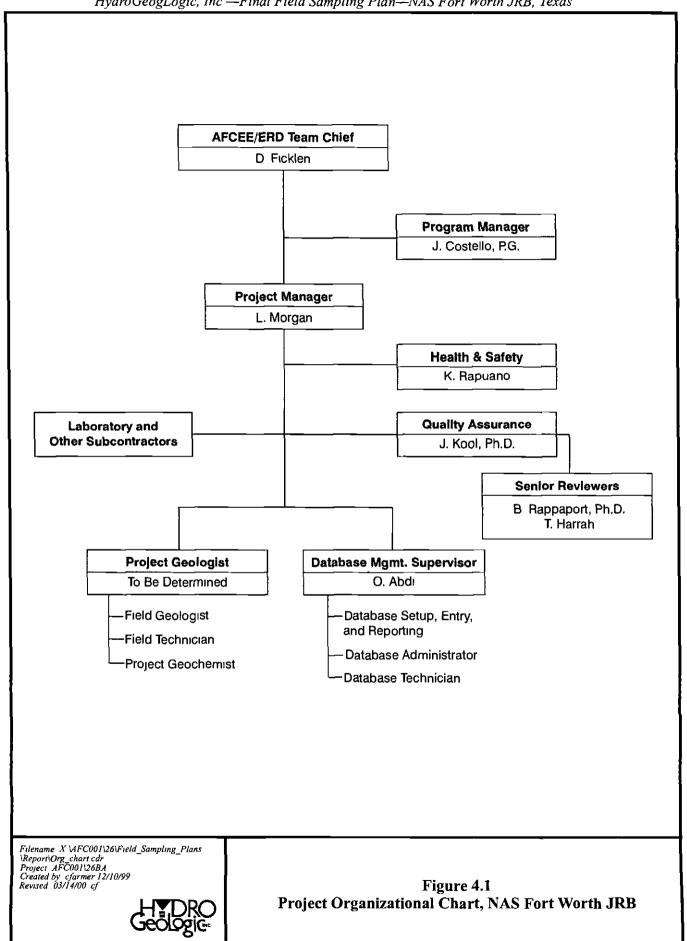
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# TAB

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# FINAL HEALTH AND SAFETY PLAN RCRA FACILITY INVESTIGATION OF SWMUS 19, 20, 21, AND 53; AND SITE INVESTIGATION OF AOCS 17, 18, AND 19 AT NAS FORT WORTH JRB, TEXAS



Prepared for

U.S. Air Force Center for Environmental Excellence Brooks AFB, Texas

Contract Number F41624-95-D-8005

April 2000

#### **FINAL**

#### HEALTH AND SAFETY PLAN RCRA FACILITY INVESTIGATION OF SWMUS 19, 20, 21, AND 53;

### AND SITE INVESTIGATION OF AOCS 17, 18, AND 19 AT NAS FORT WORTH JRB, TEXAS

**PROJECT:** U.S. Air Force Center for Environmental Excellence

PROJECT NUMBER: Contract No. F41624-95-D-8005

HydroGeoLogic Project No. AFC001-0026 and 0029

PROJECT SITE LOCATION: NAS Fort Worth JRB, Texas

**PROJECT MANAGER:** Lynn Morgan

**HEALTH AND SAFETY OFFICER:** Kenneth F. Rapuano

SITE SAFETY OFFICER: TBA

PLAN PREPARER: Jorie Wilson

PREPARATION DATE: April 2000

APPROVED BY:

Kenneth F. Rapuano

Date

HydroGeoLogic, Inc.

Health and Safety Officer

Lynn Morgan V HydroGeoLogic, Inc.

Project Manager

Date

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#### LIST OF ACRONYMS AND ABBREVIATIONS

AFCEE U.S. Air Force Center for Environmental Excellence

ANSI American National Standards Institute

AOC area of concern

AST underground storage tank

°C degrees Celsius

CAFB Carswell Air Force Base
CFR Code of Federal Regulations

COR contracting officer's representative

CPC chemical protective clothing CPR cardiopulmonary resuscitation

dB(A) decibel A-weighted scale

EPA U.S. Environmental Protection Agency

°F degrees Fahrenheit

FAR Federal Acquisition Regulation

FSP Field Sampling Plan FTA-2 Fire Training Area No. 2

HAZWOPER Hazardous Waste Site Operations
HCS hazard communication standard
HEPA high efficiency particulate air
HPS Hantarirus Pulmoney Syndrome

HSO Health and Safety Officer HSP Health and Safety Plan HydroGeoLogic HydroGeoLogic, Inc.

JRB Joint Reserve Base

LEL lower explosive limit

MEK methyl ethyl ketone

mg/m<sup>3</sup> milligrams per cubic meter MSDS Material Safety Data Sheet

NAS Naval Air Station

NIOSH National Institute for Occupational Safety and Health

O <sub>2</sub> OWS OSHA	oxygen oil/water separator Occupational Safety and Health Administration
P.G. PEL PID PM POC PPE ppm PVC	Professional Geologist permissible exposure limit photoionization detector Project Manager point of contact personal protective equipment parts per million polyvinyl chloride
RCO RCRA RFI SI	Responsible Corporate Officer Resource Conservation and Recovery Act RCRA Facility Investigation Site Investigation
SSO SWMU	Site Safety Officer solid waste management unit
T T <sub>aj</sub> TLV	air temperature adjusted air temperature threshold limit value
UEL USCG UST	upper explosive limit U.S. Coast Guard underground storage tank
WP	Work Plan

# FINAL HEALTH AND SAFETY PLAN RCRA FACILITY INVESTIGATION OF SWMUS 19, 20, 21, AND 53; AND SITE INVESTIGATION OF AOCS 17, 18, AND 19 AT NAS FORT WORTH JRB, TEXAS

#### 1.0 INTRODUCTION

#### 1.1 PURPOSE

This Health and Safety Plan (HSP) is designed to assign responsibilities, establish personnel protection standards, specify mandatory operating procedures, and provide for emergency contingencies with respect to health and safety issues that may arise while HydroGeoLogic, Inc. (HydroGeoLogic) personnel and subcontractor personnel are engaged in Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) and Site Investigation (SI) activities at the following sites:

- Solid Waste Management Unit (SWMU) 19 (Fire Training Area No. 2)
- SWMU 20 (Waste Fuel Storage Tank)
- SWMU 21 (Waste Oil Tank)
- SWMU 53 (Storm Water Drainage System)
- Area of Concern (AOC) 17 (Suspected Former Landfill Location)
- AOC 18 (Suspected Former Fire Training Area A)
- AOC 19 (Suspected Former Fire Training Area B)

All of the sites are located within the former Carswell Air Force Base (CAFB), now referred to as Naval Air Station (NAS) Fort Worth Joint Reserve Base (JRB), located in Fort Worth, Texas. The RFI activities at SWMUs 19, 20, 21, and 53 were requested through statements of work dated May 7, 1999 and May 10, 1999, under the authorization of U.S. Air Force Center for Environmental Excellence (AFCEE) Contract Number F41624-95-D-8005, Delivery Order Numbers 0026 and 0029. SI activities were also requested at AOCs 17, 18, and 19 through the statement of work dated May 10, 1999 under Delivery Order Number 0026.

This HSP conforms to the requirements of Occupational Safety and Health Administration (OSHA) Standard 29 Code of Federal Regulations (CFR) 1910 and 1926. Detailed OSHA requirements for hazardous waste operations are contained in OSHA Standard 29 CFR 1910.120 and OSHA Standard 29 CFR 1926.65, "Hazardous Waste Operations and Emergency Response." Additional guidance for hazardous waste operations may be found in the U. S. Environmental Protection Agency (EPA) publication "Standard Operating Safety Guides" (June 1992), the National Institute of Occupational Safety and Health (NIOSH)/OSHA/U.S. Coast Guard (USCG)/EPA publication "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" (October 1985), and Federal Acquisition Regulation (FAR) clause 52.236-13, Accident Prevention.

This HSP is based on available background information regarding possible chemical, physical, and biological hazards that may exist at each of the sites. If more information concerning the nature and/or concentrations of contaminants becomes available, this HSP will be amended accordingly.

#### 1.2 APPLICABILITY

The provisions of the HSP are mandatory for all official visitors, HydroGeoLogic employees, and subcontractors while investigations are being conducted at NAS Fort Worth JRB. These investigations will include the completion and sampling of approximately 51 soil borings and possibly 7 monitoring wells to evaluate the nature and extent of the potential contamination associated with each of the SWMUs and AOCs. Inadequate health and safety precautions on the part of visitors or subcontractors, or the belief that personnel on the site are or may be exposed to an immediate health hazard, can be cause for HydroGeoLogic to suspend on-site activities and require all personnel to evacuate the area.

#### 1.3 PROJECT ORGANIZATION, PERSONNEL, AND RESPONSIBILITIES

This section outlines HydroGeoLogic's personnel organization for this project as presented in Figure 4.1 of the Field Sampling Plan (FSP) and establishes the roles and responsibilities of various project personnel regarding site health and safety. The authority and responsibilities of each HydroGeoLogic individual utilized for this project are presented in the following sections.

#### 1.3.1 Responsible Corporate Officer

The Responsible Corporate Officer (RCO) for this project will be Jim Costello, P.G. The RCO has authority to direct changes to the Corporate Health and Safety Program and determines and implements personnel disciplinary actions, as required. The RCO's responsibilities for this project include the following:

- Direct and monitor the implementation of the Corporate Health and Safety Program
- Advise on health and safety matters
- Issue directives, advisories, and information to the Health and Safety Officer (HSO)

#### 1.3.2 Health and Safety Officer

The HSO for this project will be Ken Rapuano. The HSO has the authority to:

- Suspend work or otherwise limit exposure to personnel if health and safety plans appear to be unsuitable or inadequate
- Direct personnel to change work practices if existing practices are deemed to be hazardous to their health and safety

- Remove personnel from projects if their actions or conditions endanger their health and safety or the health and safety of coworkers
- Approve the qualifications of employees to work at hazardous waste sites
- Approve health and safety plans

The HSO responsibilities for this project will include the following:

- Interfacing with the Project Manager (PM) in matters of health and safety
- Keeping the RCO and PM informed on the status of the site health and safety plan
- Developing or reviewing and approving project health and safety plans prior to submittal
- Conducting staff training and orientation on health and safety-related activities
- Appointing or approving the Site Safety Officer (SSO)
- Monitoring compliance with health and safety plans and conducting site audits
- Assisting in obtaining required health and safety equipment
- Approving personnel to work on hazardous waste management projects with regard to medical examinations and health and safety training
- Maintaining records pertaining to medical surveillance, training, fit testing, chemical exposure, and accidents/incidents
- Providing industrial hygiene/chemical safety guidance

#### 1.3.3 Project Manager

The PM for this project will be Lynn Morgan. The PM has the authority to

- Coordinate with the HSO on health and safety matters
- Assign an HSO-approved SSO to the project and, if necessary, assign a suitably qualified replacement
- Temporarily suspend field activities if health and safety of personnel are endangered, pending an evaluation by the HSO
- Temporarily suspend an individual from field activities for infractions of the health and safety plan, pending an evaluation by the HSO

The PM responsibilities for this project will include the following:

- Ensuring that the project is performed in a manner consistent with the health and safety program
- Ensuring that the project health and safety plan is prepared, approved, and properly implemented
- Providing the HSO with the information needed to develop health and safety plans
- Ensuring that adequate funds are allocated to fully implement project health and safety plans

#### 1.3.4 Site Safety Officer

The SSO will direct all on-site health and safety training and daily safety inspections. A qualified HydroGeoLogic employee who has performed these functions previously will be the designated SSO. The SSO has the authority to temporarily suspend field activities if the health and safety of personnel are endangered, pending further consideration by the HSO, and to temporarily suspend an individual from field activities for infractions of the health and safety plan, pending an evaluation by the HSO.

The SSO will report any problems or concerns to the HydroGeoLogic HSO and PM. The HSO will also review accident reports and air monitoring data sheets; however, because these reviews are necessarily conducted after the fact, the SSO remains the person responsible for on-site safety. At the facilities, the SSO has primary responsibility for

- Directing health and safety activities on the site
- Ensuring that appropriate personal protective equipment (PPE) is available and properly utilized by HydroGeoLogic personnel, visitors, and subcontractor personnel
- Ensuring that personnel are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and are aware of planned procedures for dealing with emergencies
- Ensuring that personnel are aware of the potential hazards associated with investigation activities
- Monitoring the safety performance of all personnel to ensure that required work practices are followed
- Monitoring the physical condition of site workers for heat and cold stress
- Correcting any work practices or conditions that may result in injury or exposure to hazardous substances

- Ensuring the completion of the site-specific HSP forms presented in Section 14.1 (e.g., Compliance Agreement, Accident/Incident Reports, Site Safety Briefing Form, etc.)
- Ensuring that a copy of the HSP is maintained on the site during all investigation activities
- Ensuring that all air monitoring and equipment calibrations required by the HSP are performed and recorded, and that logs/forms that include these activities are maintained (Section 14.1)
- Ensuring that the subcontractor's medical monitoring program is adequate per OSHA Standard 29 CFR 1910.120 and this HSP
- Verifying OSHA 40-hour health and safety training before admitting official site visitors (e.g., Air Force and regulatory representatives) in an exclusion zone and verifying medical certification and fit-testing for respirator use for visitors requesting admittance into a Level C PPE exclusion zone (per OSHA Standard 29 CFR 1910.120).

#### 1.3.5 Project Field Personnel

Personnel working on this project will be approved by the PM and the HSO and will meet the qualifications outlined in OSHA Standard 29 CFR 1910.120, and this HSP. The project personnel involved in on-site investigations and operations are responsible for

- Taking all reasonable precautions to prevent injury to themselves and to their fellow employees
- Implementing the HSP and reporting any deviations from the anticipated conditions described in the plans to the SSO
- Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the SSO

#### 1.3.6 Subcontractor Responsibilities

It is the responsibility of each HydroGeoLogic subcontractor to ensure compliance with all applicable Federal and state regulations, including OSHA Standard 29 CFR, Parts 1900 through 1910, and Part 1926, and the contents of this HSP. Specifically contained within these OSHA regulations is OSHA Standard 29 CFR 1910.120, which includes requirements for training and medical surveillance for employees engaged in certain hazardous waste operations.

#### 2.0 SITE DESCRIPTION INFORMATION

A detailed description of the NAS Fort Worth JRB sites under investigation is presented in Section 1.0 of the Work Plan (WP). Please refer to that section for detailed site description information.

#### 2.1 DESCRIPTION OF SWMUs 19, 20, and 21

SWMU 19, the Fire Training Area No. 2 (FTA-2), SWMU 20, the Waste Fuel Storage Tank, and SWMU 21, the Waste Oil Tank, were located between the north-south taxiway and the former radar facility at Landfill No. 4. As these sites are related, they will be considered as one area for the purposes of this investigation.

SWMU 19 was used as a fire training area from 1963 until approximately 1993 by the base fire department to simulate aircraft fires for training exercises. SWMU 20 was an 8,500-gallon concrete above ground storage tank (AST) located approximately 50 feet from the southwest side of SWMU 19 and approximately 200 feet from a tributary of Farmers Branch Creek. SWMU 20 stored flammable liquid wastes including JP-4, waste oils, kerosene, and possibly solvents used during fire training exercises (A.T. Kearney, 1989). The AST and associated piping were removed from the site in 1993 (Dames & Moore, 1995). SWMU 21 consisted of a 9,500-gallon underground storage tank (UST) that was used to store waste oils and solvents from the flightline industrial shops, for eventual use at the inner bermed area of SWMU 19 during training exercises. SWMU 21 was reported to have been installed in 1963 and removed prior to 1993. Although SWMU 21 was reported to have existed at the SWMU 19 fire training area, the exact location of the UST is unknown (Radian, 1986a).

#### 2.2 DESCRIPTION OF SWMU 53

SWMU 53, the Stormwater Drainage System, is suspected to have existed since maintenance operations began at the facility in 1942. SWMU 53 begins east of Haile Drive on the north side of the Building 1190 oil/water separator (OWS) (SWMU 52), and continues to the southeast through the POL Tank Farm (SWMU 68), to where it eventually ends at the intersection of Hercules and Desert Storm Roads. SWMU 53 formerly consisted of an unlined ditch from its point of origin to the point where it intersected the POL Tank Farm. At the POL Tank Farm SWMU 53 became a concrete-lined channel (CH2M Hill, 1984).

#### 2.3 DESCRIPTION OF AOC 17

AOC 17 is a suspected former landfill that extends from the west side of Building 1840, along the southwest side of Building 1820, to where it eventually ends at the north of Building 1803. This site was identified on aerial photographs of NAS Fort Worth JRB during the period of April 10, 1942 through April 4, 1944. Figure 1.7 in the WP illustrates an aerial photo identifying the suspected landfill overlain on a current site map. Currently, the surface of AOC 17 is covered partially by grass and partially by the parking lot along the southwest side of Building 1820.

#### 2.4 DESCRIPTION OF AOC 18

AOC 18 (Suspected Former Fire Training Area A) is located east of Building 1101, just north of Phillips Circle and south of Hobby Shop Road. This site was identified on aerial photographs of NAS Fort Worth JRB during the period of December 31, 1950 through January 4, 1953. Figure 1.9 in the WP illustrates an aerial photo identifying the suspected fire training area overlain on a current site map. Currently, the location of AOC 18 is covered partially by Building 1058 and a variety of sheds, partially by an asphalt parking lot, and partially by grass.

#### 2.5 DESCRIPTION OF AOC 19

AOC 19 (Suspected Former Fire Training Area B) is located south of taxiway Charlie, west of Landfill No. 8 (SWMU 25), and north of Farmers Branch Creek. This site was identified on aerial photographs of NAS Fort Worth JRB during the period of February 3, 1954 through August 22, 1962. Figure 1.11 in the WP illustrates an aerial photo identifying the suspected fire training area overlain on a current site map. Currently, the location of AOC 19 is covered by grass.

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#### 3.0 RCRA FACILITY INVESTIGATION ACTIVITIES

RFI and SI activities to be conducted at the NAS Fort Worth JRB will include the following:

- Soil borings will be completed to the top of the water table at each unit and the soil will be sampled to determine if a release has occurred.
- Additional borings will be advanced and sampled, as necessary, to ensure that the horizontal extent of any potential contamination is evaluated.
- Monitoring wells will be installed at selected sites and the groundwater will be sampled to further characterize the extent of any contamination encountered. Additional sampling will be conducted, as necessary, using additional soil borings and/or monitoring wells.
- Piezometers will be installed at selected sites in order to determine groundwater flow directions.
- Geophysical surveys will be performed to determine if subsurface anomalies exist in selected areas.

#### 4.0 HAZARD ASSESSMENT

This section identifies and evaluates potential site hazards that may be encountered during RFI/SI activities. Control measures to protect site personnel from these potential hazards are incorporated throughout this HSP, but are located primarily in the following sections:

- Section 6.0, Air Monitoring
- Section 7.0, Personal Protective Equipment
- Section 11.0, Standard Work Practices

#### 4.1 CHEMICAL HAZARDS

The primary concerns from a chemical exposure standpoint are inhalation, ingestion, and absorption by direct skin contact with contaminants in locations expected to be source areas. Based upon the information obtained from previous site investigations (groundwater and soil), the primary chemicals of concern at NAS Fort Worth JRB have been identified and are listed in Table 4.1, along with their exposure limits and recognition properties. The acute and chronic symptoms of overexposure to these chemical contaminants and first aid procedures are presented in Table 4.2. If additional contaminants are identified during project activities, this HSP will be amended accordingly.

#### 4.2 DECONTAMINATION SOLUTIONS AND PRESERVATIVES

Chemicals used to decontaminate sampling equipment and to preserve environmental samples also present hazards to the project personnel who use them. The chemicals likely to be brought to the site for use in this manner include the following:

- Nitric Acid
- Hydrochloric Acid
- Sulfuric Acid
- Methanol
- Hexane
- Liquid Tide TM
- Alconox TM

Although overexposure to these chemicals is unlikely, the acute and chronic symptoms and first aid procedures are also presented in Table 4.2.

In order to communicate the hazards of these chemicals to site personnel, Material Safety Data Sheets (MSDSs) for each of these chemicals will be maintained on-site and presented as part of the site-specific training (Section 10.2).

#### 4.3 PHYSICAL HAZARDS

The following section titles identify physical hazards that may be encountered. They include, but are not limited to:

- Hot or Cold Work Environments (Stress)
- Noise Hazards
- Materials Handling
- Utility Hazards
- Fall, Trip, and Slip Hazards (Section 11.0)
- Flammable/Explosive Atmospheres (Section 6.0)
- Heavy Equipment/Vehicular Activity (Section 11.0)

Control measures to help protect site personnel from these potential hazards are incorporated in the following subsections and throughout this HSP.

#### 4.3.1 Heat Stress

Heat stress can be a problem, especially if personnel must perform site activities while wearing PPE in warm, humid weather conditions. The four types of heat illness in increasing order of severity include heat rash, heat cramps, heat exhaustion, and heat stroke.

- Heat rash may result from continuous exposure to heat or humid air.
- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement.
   Signs and symptoms include muscle spasms and pain in the hands, feet, and abdomen.
- Heat exhaustion occurs from increased stress on various body organs, including inadequate blood circulation due to cardiovascular insufficiency or dehydration.
   Signs and symptoms include pale, cool, and moist skin; heavy sweating; dizziness, fainting, and nausea.
- Heat stroke is the most serious form of heat stress. Temperature regulation fails and body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury or death occurs. When heat stroke is suspected, professional medical help must be obtained immediately. Signs and symptoms include red, hot, and unusually dry skin; lack of or reduced perspiration; dizziness and confusion; strong, rapid pulse; and coma.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important, because once someone suffers from heat stroke or heat exhaustion, that person may be predisposed to additional injuries. To avoid heat stress, the following steps should be taken:

- Work schedules should be adjusted. The following guidelines of rest and cooling of the body will be followed to minimize the effects of heat stress:
  - If oral temperature exceeds 99.6 Fahrenheit (°F) (37.6 degrees Celsius [°C]), shorten the next work cycle by one-third without changing the rest period.
  - If oral temperature still exceeds 99.6 °F (37.6 °C) at the beginning of the next rest period, shorten the following work cycle by one-third.
  - Do not permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6 °F (38.1 °C).

Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (See Table 4.3). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

- Shelter (equipped with air conditioners and other cooling devices, if possible) or shaded areas should be provided to protect personnel during rest periods.
- Workers' body fluids should be maintained at normal levels to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water perspired, which will vary from day to day. The normal thirst mechanism is not sensitive enough to ensure that water intake is sufficient to replace water lost through perspiration. When heavy sweating occurs, workers should be encouraged to drink more. Have workers drink fluid (preferably water or diluted drinks) before beginning work. Urge workers to drink a cup or two at each scheduled break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but will depend on actual fluid replacement needs, which will vary depending on the sweat rate.
- The drinking water temperature should be maintained at 50 °F to 60 °F (10 °C to 15.6 °C).
- Disposable cups that hold about 16 ounces should be provided.
- Workers should be encouraged to maintain an optimal level of physical fitness. Where indicated, acclimatize workers to site work conditions.
- Workers should be trained to recognize, identify, and treat heat stress.

When heat stress is suspected, the following steps should be taken:

- Move the victim out of the heat.
- Loosen tight clothing.
- Remove perspiration-soaked clothing.

- Apply cool, wet cloths to the skin.
- Fan the victim.
- If the victim is conscious, give cool water to drink. Do not give electrolyte solutions (i.e., those containing salt) to victims of heat stress because it can cause nausea and vomiting. Only small sips of cool water should be administered to heat stress victims.
- Call for an ambulance if the victim refuses water, vomits, or starts to lose consciousness.

#### 4.3.2 Cold Stress

If site work is to be conducted during the winter, cold stress is a concern to the health and safety of personnel. Special concern must be taken with regard to the wearing of Tyvek™ suits in cold weather. Such disposable clothing does not "breathe," perspiration does not evaporate, and the suits can become wet. Wet clothes combined with cold temperatures can lead to hypothermia. If the air temperature is less than 40 °F and an employee perspires, the employee must change to dry clothes.

The following are the five degrees of cold stress in increasing order of severity:

- Incipient frostbite is a mild form of cold stress characterized by sudden blanching or whitening of the skin.
- Chilblain is an inflammation of the hands and feet caused by exposure to cold moisture. It is characterized by a recurrent localized itching, swelling, and painful inflammation of the fingers, toes, or ears. Such a sequence produces severe spasms, accompanied by pain.
- Second-degree frostbite is manifested by skin with a white, waxy appearance that is firm to the touch. Individuals with this condition are generally not aware of its seriousness because the underlying nerves are frozen and unable to transmit signals to the body. Immediate first aid and medical treatment are required.
- Third-degree frostbite will appear as blue, blotchy skin. The tissue is cold, pale, and solid. Immediate medical attention is required.
- Hypothermia develops when body temperature falls below a critical level. In extreme cases, cardiac failure and death may occur. Immediate medical attention is warranted when the following symptoms are observed: involuntary shivering, irrational behavior, slurred speech, and sluggishness.

To care for any frostbite, handle the area gently. Never rub an affected area because rubbing causes further damage to soft tissues. Warm the affected area gently by soaking the affected part

in water no warmer than 105° F. Keep the frostbitten part in the water until it looks red and feels warm. Loosely bandage the affected area with a dry, sterile dressing. If fingers or toes are frostbitten, place cotton or gauze between them. Do not break any blisters caused by frostbite. Obtain professional medical attention as soon as possible.

To treat hypothermia, start by caring for any life-threatening problems and call for emergency medical assistance. Remove any wet clothing and dry the victim. Warm the body gradually by wrapping the victim in blankets or putting on dry clothing and moving him or her to a warm place. If available, apply heat pads or other heat sources to the body, but be sure to keep a barrier such as a blanket, towel, or clothing between the heat source and the victim to avoid burning the victim. If the victim is alert, give warm liquids to drink. Do not warm the victim too quickly, such as by immersing the victim in warm water, because rapid rewarming can cause dangerous heart problems. In cases of severe hypothermia, the victim may be unconscious. Should the victim stop breathing, give rescue breathing and be prepared to administer cardiopulmonary resuscitation (CPR).

#### 4.3.3 Noise Hazards

The SSO or designee will monitor high noise levels when equipment or machinery (e.g. backhoe, drill rig, etc.) is being used on-site. Field personnel working in areas where noise levels can be expected to reach or exceed 85 decibels on the decibel A-weighted scale (dB(A)) will be issued hearing protection to reduce the level below the 85 dBA threshold. Compliance standards for occupational noise exposure are found in 20 CFR 1910.95.

#### 4.3.4 Materials Handling

The most common type of materials handling accident involves fingers or toes of field personnel being caught between two objects. Special precautions must be implemented during the moving, shifting, or rolling of materials; and these activities should never be attempted by a single individual. Workers are required to use proper lifting techniques for handling materials, and oversized or heavy loads require "team lift" procedures.

#### 4.3.5 Utility Hazards

The locations of all underground utilities must be identified and marked prior to initiating any subsurface investigations. In addition, drilling within 20 feet in any direction of overhead power lines will not be permitted.

#### 4.4 BIOLOGICAL HAZARDS

The biological hazards that could be encountered by site personnel include, but are not limited to, the following:

- Poisonous Animals
- Ticks
- Animal-Borne Diseases

• Poisonous Plants (e.g., poison sumac, poison ivy, poison oak)

Control measures to protect site personnel from these biological hazards are included in the following sections.

#### 4.4.1 Poisonous Animals

Poisonous animals that pose a potential threat at NAS Fort Worth JRB include snakes, insects (ants, bees, wasps), and spiders. Rattlesnakes are the most common poisonous snake in the area. Reactions from a snakebite are aggravated by acute fear and anxiety. Other factors that affect the severity of local and general reaction from a poisonous snakebite include the amount of venom injected and the speed of absorption of venom into the victim's circulation; the size of the victim; protection provided by clothing, including shoes and gloves; quick anti-venom therapy; and location of the bite. Poisoning can occur from injection or absorption of venom through cuts or scratches. Personnel should avoid walking in grass or underbrush at night and not climb rocky ledges without prior visual inspection. Field personnel should wear high-top boots and heavy pants since more than half of all snakebites are on the lower parts of the legs. Workers should not attempt to kill snakes unnecessarily as many people are bitten in such attempts.

Biting and stinging insects, such as ants, bees, and wasps, are very common. Generally, the bite and stings from these insects, although painful, are not dangerous; however, if bitten or stung by a large number of these insects, an individual may experience serious injury or even death. This is especially true of individuals who are particularly sensitive or allergic to insect toxins. Most of these insects live in easily recognizable nests, but many are encountered far from their nest. Care should be taken when entering little-used structures (sheds, utility buildings) and when opening monitoring well covers.

Spiders in the United States are generally harmless, with two notable exceptions: the black widow spider (*Latrodectus mactans*) and the brown recluse or violin spider (*Lox osceles reclusa*). The symptoms of a black widow spider bite are slight local reaction, severe pain produced by nerve toxin, profuse sweating, nausea, painful cramps in abdominal muscles, and difficulty in breathing and speaking. The symptoms of a brown recluse spider bite can be mild to severe. In the mildest form, the bite can cause pain and swelling like a bee sting or ant bite. If the reaction is severe, the bite area may become swollen, painful, and weep fluid. Swelling and reddening may spread to an entire limb, and if left untreated, the bite may cause necrosis of surrounding tissue and infection. Diarrhea, stomach cramps, and hot/cold flashes may also occur. Victims of poisonous spider bites recover in almost all cases, but an occasional death is reported.

Field personnel should exercise caution when lifting items such as logs, rocks, covers to manholes, and sump covers where poisonous animals could be encountered.

#### 4.4.1.1 First Aid Procedures (Snakebite)

The objective of first aid is to reduce the circulation of blood through the bite area, to delay absorption of venom, to prevent aggravation of the local wound, and to sustain respiration.

Several steps are listed to properly care for a snakebite victim. The most important step is to get the snakebite victim to the hospital quickly. In addition, take the following first aid measures:

- Keep the victim from moving around.
- Keep the victim as calm as possible and preferably in a lying position.
- Immobilize the bitten extremity and keep it at or below heart level. If the victim can reach a hospital within 4 to 5 hours, and if no symptoms develop, no further first aid measures need to be applied.
- If mild-to-moderate symptoms develop, apply a constricting band 2 to 4 inches above the bite, but not around a joint (the elbow, knee, wrist, or ankle) and not around the head, neck, or trunk. The band should be ¾ to 1½ inches wide, not thin like a rubber band. The band should be snug but loose enough for a finger to be slipped underneath. Watch for swelling and loosen the band if it becomes too tight, but do not remove it. Periodically check the pulse in the extremity beyond the bite to insure that the blood flow has not completely stopped.

Several other factors must be considered in cases of snakebite:

- Shock. Keep the victim lying down and comfortable, and maintain his or her body temperature.
- <u>Breathing and heartbeat</u>. If breathing stops, give mouth-to-mouth resuscitation. If breathing stops and there is no pulse, perform CPR if you have been trained to do so.
- <u>Identifying the snake</u>. If you can kill the snake without risk or delay, bring it to the hospital for identification, but exercise extreme caution in handling the snake.
- Cleaning the bitten area. You may wash the bitten area with soap and water and blot it dry with sterile gauze. You may apply dressings and bandages, but only for a short period of time.
- Medicine to relieve pain. Do not give the victim alcohol, sedatives, aspirin, or any
  medicine containing aspirin. Consult a doctor or other medical personnel for specific
  medications that may be used.
- Snakebite kits. Keep a kit accessible for all outings in primitive areas or areas known or suspected to be snake infested.

It is not recommended that cold compresses, ice, dry ice, chemical ice packs, spray refrigerants, or other methods of cold therapy be used in the first aid treatment of a snakebite.

# 4.4.1.2 General First Aid for Poisonous Insect Bites/Stings

For minor bites and stings use cold applications and soothing lotions, such as calamine. For more severe reactions, take the following first aid measures,

- Apply a constricting band above the injection site on the victim's arm or leg (between the site and the heart). Do not apply tightly. You should be able to slip your index finger under the band when it is in place. Give artificial respiration if necessary.
- Keep the affected part below the level of the victim's heart.
- If medical care is ready available, leave the band in place; otherwise, remove it after 30 minutes.
- Apply ice contained in a towel or plastic bag, or cold cloths, to the site of the sting or bite.
- Give home medicine, such as aspirin, for pain.
- If the victim has a history of allergic reactions to insect bites/stings or is subject to attacks of hay fever or asthma, or if he or she is not promptly relieved of symptoms, call a physician or take the victim immediately to the nearest location where medical treatment is available. In a highly sensitive person, do not wait for symptoms to appear, since delay can be fatal.
- In case of a bee sting, use tweezers to remove and discard the stinger and venom sac.

Workers who have had severe allergic reactions to bee/wasp stings in the past must inform the SSO when they arrive at the site for the first time.

### 4.4.2 Ticks

Field personnel should be aware of the presence of ticks at the site. When in an area suspected of harboring ticks (grassy, bushy, or woodland area) the following precautions can minimize the chances of being bitten by a tick:

- Wear long pants and long-sleeved shirts that fit tightly at the ankles and wrists.
- Wear light colored clothing so ticks can be easily spotted.
- Wear tick repellents.
- Inspect clothing frequently while in tick habitat.
- Inspect your head and body thoroughly when you return from the field.

Removal of ticks is best accomplished using small tweezers. Do not squeeze the tick's body. Grasp it where the mouth parts enter the skin and tug gently, not firmly, until it releases its hold on the skin. Save the tick in a jar labeled with the date, body location of the bite, and the place where it may have been acquired. Wipe the bite thoroughly with an antiseptic. Seek medical attention in the event tick-related disease symptoms develop.

Lyme disease is an illness caused by a bacterium that may be transmitted by the bite of a tick (Ixodes dammini), commonly referred to as the deer tick. Not all ticks are infected with the bacterium, however. When an infected tick bites, the bacterium is passed into the bloodstream of the host, where it multiplies. The various stages and symptoms of the disease are well recognized and, if detected early, can be treated with antibiotics.

The illness typically occurs in the summer and is characterized by a slowly expanding red rash, which develops a few days to a few weeks after the bite of an infected tick. This may be accompanied by flu-like symptoms along with headache, stiff neck, fever, muscle aches, and/or general malaise. At this stage treatment by a physician is usually effective, but, if left too long, these early symptoms may disappear and more serious problems may follow. The most common late symptom of the untreated disease is arthritis. Other problems that may occur include meningitis and neurological and cardiac abnormalities. It is important to note that some people do not get the characteristic rash but progress directly to the later manifestations. Treatment of later symptoms is more difficult than early symptoms and is not always successful.

### 4.4.3 Animal-Borne Diseases

There are three principal diseases that can be transmitted by contact with rodents and other animals: rabies, bubonic plague, and hantavirus pulmonary syndrome (HPS). For this reason, field personnel will avoid all contact with rodents and other animals (alive or dead), rodent droppings, and rodent nests. All of these should be considered to be potentially contaminated with life-threatening pathogens.

Rabies is a disease that is transmitted through the saliva of rodents, as well as other mammals, such as dogs, cats, raccoons, foxes, bats, and cattle. An animal infected with the disease may act strangely (e.g., not afraid of humans, out at the wrong time of day or night), drool, or appear partially paralyzed. If left untreated, rabies is a fatal disease. If someone is bitten by an animal, treat the wound first, especially if the bleeding is serious, then get the person immediate medical attention. Do not attempt to kill or capture the animal, as further injuries could result. Call the local animal control authorities, and provide them with a description of the animal and the location of the incident.

Bubonic plague is the disease that was the cause of the plague known as the Black Death which decimated the populations of Europe in the Middle Ages and Renaissance. The disease is caused by a bacterium carried by the oriental rat flea, Xenopsylla cheopis, which is found on rats, mice, and jackrabbits. Epidemics of the disease do not occur in the U.S., but isolated cases have occurred in the southwestern states. The symptoms of the disease are a dark, pimple-like inflammation at the site of the bite, followed by a swelling of the lymph node closest to the bite area. The victim will develop an extremely high fever and dark splotching due to subcutaneous hemorrhaging. Untreated bubonic plague has a mortality rate of approximately 60%; however, the disease responds well when treated promptly with antibiotics (though not penicillin).

HPS is an infectious respiratory disease caused by exposure to the hantavirus. While cases of HPS are rare (generally less than 50 per year), HPS is fatal in approximately half the reported cases. This virus is present throughout the southwestern U.S. and is carried by rodents, especially mice. The virus enters the human body by the inhalation of particles, such as dust, which has become contaminated by the virus by exposure to rodent saliva, urine, or droppings. If personnel are exposed to rodents, droppings, or rodent nests, get immediate medical attention. HPS can be diagnosed using an antibody test. The symptoms of HPS are initially flu-like; after three to five days, the victim will develop coughing and shortness of breath, which will rapidly become more serious. At this point, it is imperative that the victim receive medical attention. If treated in time, there is an excellent chance of surviving the disease; however, untreated HPS is very often fatal.

Armadillos are common in the Fort Worth area. These animals are nocturnal and avoid humans, but are often found dead, especially along roads. It is estimated that 5% of these animals carry the bacillus that causes leprosy, *Mycobacterium leprae*. This disease is not very contagious (it is believed that up to 95% of all humans are naturally immune); however, all dead armadillos encountered at the site should be treated as potentially infectious and avoided.

### 4.4.4 Poisonous Plants

The majority of skin reactions following contact with offending plants are allergic in nature and are characterized by general symptoms of headache and fever, itching, redness, and rash.

Some of the most common and most severe allergic reactions result from contact with plants of the poison ivy group including poison ivy, poison oak, and poison sumac. The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each. Both plants also have greenish-white flowers and berries that grow in clusters. Such plants produce a severe rash characterized by redness, blistering, swelling, and intense burning and itching. The victim can also develop a high fever and become very ill. Ordinarily, the rash begins within a few hours after exposure, but it may be delayed for 24 to 48 hours.

### 4.4.4.1 First Aid Procedure

- Remove contaminated clothing.
- Wash all exposed areas thoroughly with soap and cold water, followed by rubbing alcohol.
- Apply calamine or other soothing skin lotion if the rash is mild.
- Seek medical advice if a severe reaction occurs, or if there is a known history of previous sensitivity.

### 5.0 HAZARD COMMUNICATION

The HydroGeoLogic Hazard Communication Program complies with the OSHA hazard communication standard (HCS) found in OSHA Standard 29 CFR 1910.120 and 1926.59, which applies to any chemical present in the workplace in such a manner that employees may be exposed to under normal conditions of use in a foreseeable emergency. Although waste materials are excluded from the OSHA requirements, decontamination chemicals for sampling equipment or protective clothing and calibration standards require MSDSs.

The principle of communicating the hazards of materials used in the workplace applies to company-wide activities, from informational programs on the conduct of hazardous waste activities to the company's insistence upon adequate health and safety training. It is also important for personnel to have an awareness of client concern for hazard communication due to Federal, state, and local regulations directly affecting certain client activities.

In order to comply with the HCS, HydroGeoLogic has made the following determinations:

- All containers of hazardous chemicals must be appropriately labeled or tagged to identify the hazard and provide information on effects and appropriate protective measures.
- Labels, tags, or signs must be properly affixed and visible at all times while a hazard is present and removed promptly when the hazard no longer exists.
- Written information (i.e., MSDSs) on hazardous chemicals in the workplace must be available to employees working with the substances.
- Appropriate MSDSs will be available to any contractor or subcontractor employee working on projects under HydroGeoLogic's control.

When investigation results indicate potential imminent health risks to contracted or Federal personnel, or the public at large, the contracting officer's representative (COR) and the base point of contact (POC) will be notified as soon as practicable. Written notification and supporting documentation will be provided within 3 days of finding potential imminent health risks during investigation activities.

### 6.0 AIR MONITORING

This section presents requirements for the use of real-time air monitoring instruments during site activities involving potential for exposure to site contaminants. It establishes the types of instruments to be used, the frequency of their use, the techniques for their use, the action levels for upgrading/downgrading levels of protection, and the methods for instrument maintenance and calibration.

### 6.1 **INSTRUMENTS AND USE**

A photoionization detector (PID) equipped with an appropriate lamp will be utilized for detecting the presence of emissions from chemicals of concern. A Dräger pump and colorimetric tubes will be used to confirm any detections observed with the PID in accordance with Table 6.1. Additionally, lower explosive limit/oxygen (LEL/O<sub>2</sub>) detectors will be used during all drilling and excavation activities to detect the presence of flammable/explosive atmospheres. Visual observation will be used to detect the presence of airborne particulate.

The PID/Dräger pump will be used throughout the execution of these activities:

- Soil boring installation
- Soil sampling
- Sampling equipment decontamination/heavy equipment decontamination
- Waste characterization and disposal

### 6.2 AIR MONITORING REQUIREMENTS

### **6.2.1** Photoionization Detector

Air monitoring with the PID will be initiated at potential sources of vapor emissions (source monitoring) at specified frequencies. The frequencies will be increased where concentrations of constituents are measured. The following potential sources and monitoring frequencies are anticipated:

- The PID will be used to monitor each sample location during environmental sampling.
- The PID will be used to monitor each 5-foot interval during surface and subsurface soil sampling.
- The PID will be used to monitor each container sampled during RFI waste characterization.

If source monitoring indicates the presence of airborne emissions, air monitoring will then be initiated in the breathing zones of those workers who could be affected by the emissions. Air monitoring will also occur upon the request of site workers who notice unusual site odors or an increase in their intensity. If work is to be performed downwind of a site, air monitoring will be conducted to determine what type of PPE, if any, is required to protect workers and to determine the potential for an imminent threat to public health.

The presence of elevated readings in the worker's breathing zone as identified in Table 6.1 requires amendments to the HSP before workers are allowed to enter the exclusion zone. Depending on the air monitoring readings, air-purifying respirators may not be acceptable because some contaminants of concern have poor warning properties and/or cannot be filtered from inspired air with chemical cartridges (Table 6.1). Elevated readings will be based on confirmation sampling using a Dräger pump and colorimetric tubes in accordance with Table 6.1.

### 6.2.2 Dräger Pump and Tubes

A hand-operated Dräger pump with colorimetric tubes will be used to confirm the results of PID testing. If the results of the PID tests show concentrations greater than 0.5 parts per million (ppm) above background concentrations in the breathing zone, then the colorimetric tubes will be used to identify the contaminants in the breathing zone. Colorimetric tubes to be utilized in the event of elevated PID readings will include vinyl chloride, benzene, tetrachloroethene, or trichloroethene in accordance with Table 6.1. The colorimetric tube utilized will depend on the chemical anticipated to be present at the site.

# 6.2.3 LEL/O<sub>2</sub> Detectors

Air monitoring with the LEL/O<sub>2</sub> detectors will be conducted during all drilling and excavation activities within boreholes, and immediately over drill cuttings at every 5-foot depth interval. If elevated (above background) LEL readings are observed, personnel must be advised of the potential explosive nature and must initiate the use of spark proof tools in accordance with Table 6.1. LEL readings in excess of 10 percent requires cessation of drilling and abandonment of the drilling location until readings subside.

### 6.2.4 Visual Observations

If airborne particulate are observed and air monitoring results (as indicated in Table 6.1) warrant, personnel must don air-purifying respirators equipped with organic vapor cartridges and high efficiency particulate air (HEPA) filters. If airborne particulate are observed due to intrusive activities at these sites, dust control measures will be implemented.

### 6.3 MODIFICATION OF AIR MONITORING REQUIREMENTS

The action levels and protection measures presented in Table 6.1 are based upon the assumption that the contaminants listed in Table 4.1 are the only contaminants that pose a reasonable health risk to site workers. In the event that this assumption is found to be invalid through analysis of samples collected, or by some other means, the action levels will be modified as necessary.

# 6.4 INSTRUMENT MAINTENANCE AND CALIBRATION

Air and noise monitoring instruments are maintained and prefield-calibrated at the HydroGeoLogic office in Herndon, Virginia. Field maintenance will consist of daily cleaning of the instruments using a damp towel or rag to wipe off the instrument's outer casing, overnight battery recharging, and cleaning or replacing of the lamp whenever calibration cannot be attained. Procedures for accomplishing instrument maintenance is contained in the PID user's manual provided with each instrument. The user's manual provided with each instrument will be followed to field calibrate the instrument prior to each day of use under the environmental conditions (temperature and humidity) that sampling will occur. Field equipment will also be calibrated at the end of each day to account for instrument drift and reliability.

### 6.5 RECORD KEEPING

Instrument calibrations and readings will be recorded on the Air Monitoring Log Sheet provided in Section 14.1 of this HSP. Copies of these log sheets will be maintained on-site until field activities covered by this HSP have been completed. The log sheets will be transmitted to the HydroGeoLogic HSO and to the project file at the completion of the field work.

LEL/O<sub>2</sub> readings will not be recorded unless flammable/explosive or oxygen deficient/enriched atmospheres are detected, in which case entries will be made in the field log book.

LEL/O<sub>2</sub>, detector, and the PID will undergo daily operational checks. These checks will be recorded in the field log book and Equipment Calibration Log (Section 14.1).

# 7.0 PERSONAL PROTECTIVE EQUIPMENT

This section presents requirements for the use of PPE for each of the activities being conducted. This section includes anticipated levels of protection for each of the activities, the criteria used for selecting various levels of protection, and criteria for modifying levels of protection based on monitoring instrument readings, and personal observations.

### 7.1 ANTICIPATED LEVELS OF PROTECTION

All work is anticipated to be performed in Level D protection, as defined in Appendix B of OSHA Standard 29 CFR 1910.120. Many activities may require the use of chemical resistant coveralls, gloves, and boot covers as presented in Table 7.1.

The items of PPE anticipated to be used for each activity are presented in Table 7.1. Where overlap in activities occurs, the more protective requirement will apply.

### 7.2 PPE SELECTION CRITERIA

Respiratory protection is not anticipated for use during the initial stages of work until detectability of site contaminants with air monitoring instruments warrants the donning of respirator protection in accordance with Table 6.1. See Section 7.3 for modification criteria of respiratory protection. Basic requirements for field personnel using respiratory protection include the following:

- All field personnel will be medically certified to wear a full-face respirator and have the proper fit test documentation within the past 12 months prior to assignment.
- Only NIOSH-approved respirators are to be used on-site. The respirators are to be properly cleaned, inspected, and maintained prior to and at the conclusion of the work day.
- Cartridges to air-purifying respirators will be disposed of at the end of each work day and when load-up or breakthrough occurs.
- Field personnel will be clean shaven in areas that might prevent the seal of the respirator to the face, and contact lenses will not be permitted while wearing a respirator.

Hard hats, safety glasses, and steel-toe work boots will be used as minimum protection to reduce the potential for injury resulting from exposure to the physical hazards associated with on-site investigations.

Boot covers, disposable nitrile gloves, and Tyvek<sup>TM</sup> coveralls will be used to minimize contamination of work clothes and to prevent direct skin contact with low level contamination. Nitrile gloves of 11 mil thickness or greater will be worn for activities that may involve direct contact with appreciable concentrations of contaminants thought to be present as site contaminants.

Polyvinyl chloride (PVC) or Saranex<sup>™</sup> coveralls, hoods, and/or splash shields will be worn to prevent saturation of work clothes during activities involving large volumes of liquids and/or saturated soils/equipment.

# 7.3 PPE MODIFICATION CRITERIA

This section presents criteria for upgrading and downgrading chemical protective clothing (CPC) and/or respiratory protection. When uncertainties arise, the more protective requirement will apply.

### 7.3.1 CPC Modification Criteria

Tyvek™ coveralls and boot covers must be worn anytime there is a reasonable potential for contamination of street clothes.

Disposable nitrile gloves must be worn anytime there is a reasonable potential for contact with unsaturated soils or equipment that may contain trace contamination.

Nitrile gloves (11 mil or greater) must be worn anytime there is a reasonable potential for contact with groundwater, saturated soils, and/or soils producing elevated PID readings.

PVC or Saranex<sup>™</sup> coveralls must be worn anytime there is a reasonable potential for saturation of work clothes.

### 8.0 DECONTAMINATION

This section describes the steps site personnel will follow to prevent the spread of site contaminants into areas that may affect unprotected, unsuspecting site personnel or the public. It includes requirements for decontamination of personnel, sampling equipment, and augering/drilling equipment.

### 8.1 PERSONNEL DECONTAMINATION

The decontamination of personnel and their protective clothing will be performed within the decontamination zone. Table 8.1 presents the six stages for decontamination for Modified Level D protection.

Wash tubs containing an appropriate decontamination solution and soft-bristle brushes will be used to wash reusable PPE and boots. Clean water will be used for the final rinse. The choice of decontamination solution is dependent upon the type of materials that must be removed from reusable protective equipment. Based on the current understanding of potential site contaminants, a detergent and water solution is recommended for general purpose decontamination. Acceptable detergents include laboratory-grade cleaners (e.g., Alconox<sup>TM</sup> or equivalent), or a high strength consumer detergent such as Liquid Tide<sup>TM</sup>.

Alternative decontamination solutions may be called for if the contaminants encountered are different or in a more concentrated state than anticipated. Alternative solutions include the following:

- Dilute acids for removal of basic (caustic) compounds, amines, and hydrazines
- Dilute bases (soaps and detergents) for removal of acidic compounds, phenols, thiols and some nitro and sulfonic compounds
- Organic solvents for removal of nonpolar compounds (organic)

Gloves and other PPE should be inspected frequently for integrity, and manufacturers' data for breakthrough times should be considered if concentrated contaminants are encountered.

The decontamination of personnel and their protective clothing will be performed in 18 stages for Level C protection, if necessary. The 18 stages are presented in Table 8.2.

All decontamination fluids generated will be contained and disposed of as specified in the WP. The decontamination area will be physically identified with rope or flagging and will be sufficiently equipped to be conducive for completion of the stages listed above.

### 8.1.1 Closure of the Personnel Decontamination Station

All disposable clothing and plastic sheeting used during the operation will be double-bagged and contained on-site prior to removal to an approved off-site disposal facility as identified in the WP. Decontamination and rinse solution will be contained on-site prior to disposal. Reusable rubber clothing will be dried and prepared for future use. If contamination of non-disposable clothing

has occurred, the item will be discarded. All wash tubs, pail containers, etc., will be thoroughly washed, rinsed, and dried prior to removal from the site.

### 8.1.2 Disposal of Decontamination and Other Wastes

All PPE, polyethylene sheeting, and sampling support materials (e.g., paper towers, ziplock bags) will be collected at the end of each work day, placed in plastic trash bags, and left at the site overnight. The following day, the air within the plastic trash bag will be tested using a PID. If the air within the bag does not show significant concentrations of organic vapors (greater than 10 ppm above background), the plastic trash bag will be double-bagged and placed in the municipal waste dumpster for disposal.

All other wastes generated during decontamination other than decontamination fluids will be placed into 55-gallon drums; each drum will have a removable top cover fitted with a top cover bung (type 17E/H) as identified in the FSP. The drums will be filled partially or completely, depending upon the difficulty of transporting them from the work site. All containers will be numbered and clearly labeled with the boring/well number and date of filling. The mixing of solid and liquid wastes will be avoided. The containers will be stored at a predesignated site until the analytical results from each boring/well can be reviewed in order to determine the waste classification for handling, transportation, and disposal.

# 8.2 EQUIPMENT DECONTAMINATION

All sampling equipment will be decontaminated prior to use, between sampling locations, and at the end of sampling activities to avoid cross-contamination, to decrease contact between personnel and contaminated materials, and to reduce the probability of removing contamination from the site. The procedures for decontaminating equipment are presented in Section 5.8 of the FSP.

### 9.0 MEDICAL SURVEILLANCE

### 9.1 REQUIREMENTS FOR HYDROGEOLOGIC PERSONNEL

All employees involved in field activities will be active participants in the HydroGeoLogic medical surveillance program. All medical examinations and procedures will be performed by or under the supervision of a licensed occupational physician. The examination will include the tests, procedures, and frequencies that comply with the requirements of OSHA Standard 29 CFR 1910.120 (f) and American National Standards Institute (ANSI) Z-88.2, and will be medically qualified to perform hazardous waste site work under respiratory protection. Medical surveillance documents confirming the worker's fitness to perform hazardous waste operations on this project are on file at HydroGeoLogic's headquarters in Herndon, Virginia, and can be made available upon request.

# 9.2 REQUIREMENTS FOR SUBCONTRACTORS

Subcontractors are also required to obtain a certificate of their ability to perform hazardous waste operations work and to wear respiratory protection. Subcontractors, that have a company medical surveillance program meeting the requirements of OSHA Standard 29 CFR 1910.120 (f) will be required to submit a letter, on company letterhead, confirming that all on-site workers to be utilized for this project are medically qualified to perform the investigation activities. In addition, medical surveillance documents for personnel assigned to this project must be made available upon request.

# 10.0 TRAINING REQUIREMENTS

### 10.1 INITIAL TRAINING

### 10.1.1 Requirements for HydroGeoLogic Personnel

All investigation personnel to be utilized are currently enrolled in HydroGeoLogic's continuous training program in accordance with OSHA Standard 29 CFR 1910.120. Individuals working on a site have successfully completed an approved 40-hour Hazardous Waste Site Operations (HAZWOPER) course including 24-hours of actual field experience under the direction of a trained supervisor, and any subsequent annual 8-hour refresher courses. In addition, the on-site field leader will have completed an 8-hour supervisory course, and a majority of HydroGeoLogic's field investigation personnel are also current in first aid/CPR training requirements. HydroGeoLogic employee records are on file in the company's home office in Herndon, Virginia.

### 10.1.2 Requirements for Subcontractors

All HydroGeoLogic subcontractor personnel must also have completed a 40-hour HAZWOPER training course or the equivalent work experience as defined in OSHA Standard 29 CFR 1910.120(e) prior to performing work at the site. In addition, subcontractor personnel must also have successfully completed any subsequent annual 8-hour refresher training.

HydroGeoLogic subcontractors must certify that each subcontractor employee who will perform work at the site has had training meeting the requirements of OSHA Standard 29 CFR 1910.120(e). This certification can be accomplished by submitting a letter to HydroGeoLogic, on company letterhead, containing such information.

### 10.1.3 Requirements for Site Visitors

No person will be allowed in the work zones (exclusion and decontamination) unless they have completed the necessary health and safety training as required by OSHA Standard 29 CFR 1910.120(e) and are wearing the necessary protective equipment as required by this HSP.

### SITE-SPECIFIC TRAINING 10.2

HydroGeoLogic will provide site-specific training to all HydroGeoLogic employees and subcontractor personnel who will perform work at the site. Daily health and safety meetings will be held prior to beginning field activities to discuss each day's activities, potential hazards, and any new health and safety issues not previously discussed. Personnel who do not participate in training will not be permitted to perform work at the site. Site-specific training will include the following:

- Contents of the HSP
- Names of personnel and alternates responsible for site health and safety

- Safety, health, and other hazards present on the site
- Use of PPE
- Work practices by which the employees can minimize risks from hazards
- Safe use of engineering controls and equipment on the site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazards
- Decontamination procedures
- Emergency response procedures

HydroGeoLogic and subcontractor personnel will be required to sign a statement indicating receipt of site-specific training and understanding of site hazards and control measures. This form is presented in Section 14.1.

### 11.0 STANDARD WORK PRACTICES

All site investigation activities will follow these appropriate health and safety standard work practices.

## 11.1 GENERAL REQUIREMENTS/PROHIBITIONS

- A copy of this HSP will be available on-site for all field personnel, including visitors, to reference during investigation activities.
- No running or horseplay will be permitted.
- Eating, drinking, chewing gum or tobacco, taking medication, applying cosmetics, and/or smoking are prohibited in the exclusion and decontamination zones, or any location where a possibility for contact with site contaminants exists.
- The minimum required level of PPE to be worn by all on-site personnel will include steel-toed safety boots, safety glasses, and hard hat, if necessary.
- Upon leaving the exclusion zone, each worker's hands and face must be thoroughly washed. Any protective outer clothing is to be decontaminated and removed as specified in this HSP and left at a designated area prior to entering the clean area.
- Contact with potentially contaminated substances must be avoided. Contact with the ground or with contaminated equipment must also be avoided. Air monitoring equipment must not be placed on potentially contaminated surfaces.
- Facial hair that interferes with a satisfactory fit of the mask-to-face seal is not permitted on personnel required to wear respiratory protective equipment.
- All personnel must satisfy medical monitoring procedures.
- No flames or open fires will be permitted on-site.
- All personnel must be aware of and follow the action levels presented in this HSP for upgrading respiratory protection.
- Any new analytical data must be promptly conveyed via telephone to the project HSO by the laboratory technician or field leader.
- Personnel must develop hand signals with users of heavy equipment (e.g., drillers, geoprobe operators, etc.). Standard hand signals to be used by personnel for nonverbal communication include:

Stop	With arm extended to the side and palm down, hold position rigidly.
Hoist	With forearm and forefinger pointing up, move hand in small horizontal circle.
_	
Lower	With forearm extended and forefinger pointing down, move hand in a small
	horizontal circle.
Travel	With palm up, fingers closed, and thumb pointing in the direction of motion, jerk hand horizontally.
Slow Move	Use one hand to give any motion signal, and place the other hand motionless next to the hand giving the motion signal.
Emergency	With arm extended to the side and palm down, move hand rapidly right and
<i>C</i> ,	left.

Standard hand signals will be discussed during each daily health and safety meeting when the use of heavy equipment is anticipated.

- A copy of the OSHA "Job Safety and Health Protection" poster must be prominently posted at each site.
- Only equipment that has been approved by the manufacturer may be used in conjunction with site equipment.
- Medicine and alcohol can potentiate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Alcoholic beverage intake will not be allowed at any time, including during breaks.
- No person will enter the exclusion zone alone.
- Safety devices on equipment must be left intact and used as designed.
- Equipment and tools will be kept clean and in good repair and used only for their intended purpose.
- Eye protection must be worn when any hammering or pounding is performed that may produce flying particles or slivers.
- Field personnel are not allowed to lift more than 60 pounds. Rules to remember when attempting to lift heavy objects include:
  - Size up the load before trying to lift it, test the weight, and get help if needed.
  - Bend the knees and look up to keep the neck and back straight.
  - Do not twist or turn your body once you have made the lift.
  - Make sure you can carry the load where you need to go before lifting it.
  - Set the load down properly, lower slowly by bending the knees.
  - Always push, not pull, the object when possible.

- Heavy lifting (more than 60 pounds per worker) must be accomplished using mechanical lifting equipment. Mechanical lifting equipment that will be available onsite will include forklifts, hoists, dollies, backhoe/trackhoe, and other types of equipment that can be easily rented from an off-site location.
- Leather gloves must be worn when handling objects that may produce slivers or create a cutting or pinching hazard (e.g., driving wood stakes, handling drill rods/augers).
- No person shall climb the drill mast without the use of ANSI-approved fall protection (i.e., approved belts, lanyards, and a fall protection slide rail) or a portable ladder that meets the requirements of OSHA standards.
- The SSO must make an entry into the site field logbook at least daily to include the following:
  - Weather conditions
  - Site personnel
  - New arrivals and their clearance for site work
  - Air monitoring data summary
  - Monitoring instrument calibration
  - Indications of inhalation exposure
  - PPE used per task
  - Deviations from HSP
  - Inspection and cleaning of respiratory equipment
  - General health and safety problems/corrective actions
- If personnel note any warning properties of chemicals (irritation, odors, symptoms, etc.) or even remotely suspect the occurrence of exposure, they must immediately notify the SSO for further direction.

### DRILLING ACTIVITIES 11.2

Prior to the commencement of drilling activities, all locations will be surveyed and marked for underground utilities. In addition, a hand auger or probe will be used to a depth of 3 feet to ensure the absence of underground utilities at the location of interest. If any uncertainties exist, the location will be moved to an adjacent area.

The following general drilling practices must be adhered to during investigation activities:

All drilling equipment (i.e., rigging, derrick, hoists, augers, etc.) must be inspected by the drilling crew and SSO prior to starting work. Defective equipment will be removed from service and replaced.

- No drilling within 20 feet in any direction of overhead power lines will be permitted. The locations of all underground utilities must be identified and marked prior to initiating any subsurface activities.
- All drill rigs and other machinery with exposed moving parts must be equipped with an operational emergency stop device. Drillers and geologists must be aware of the location of this device. This device must be tested prior to job initiation and periodically thereafter. The driller and helper shall not simultaneously handle moving augers or flights unless there is a standby person to activate the emergency stop.
- Prior to raising the mast, the drill rig operator shall ensure that the proper stabilization measures have been taken. The drill rig shall not be moved while the mast is in the raised position.
- The driller must never leave the controls while the tools are rotating unless all personnel are clear of the rotating equipment.
- Drillers must wear hearing protection unless the employer can provide documentation that noise exposures are less than a dose of 50 percent as required by OSHA Standard 29 CFR 1910.95.
- Drilling activities shall immediately cease when inclement weather (e.g., heavy rains, lightning) or high winds occur at the site. All site personnel should immediately seek shelter.
- To maintain a clean operation, drill cuttings shall be promptly containerized as they are generated. A long-handled shovel or equivalent must be used to clear drill cuttings away from the hole and from rotating tools. Hands and/or feet are not to be used for this purpose.
- A remote sampling device must be used to sample drill cuttings if the tools are rotating. Samplers must not reach into or near the rotating equipment. If personnel must work near any tools, that could rotate, the driller must shut down the rig prior to initiating such work.
- Drillers, helpers, and samplers must secure all loose clothing when in the vicinity of drilling operations.
- Only equipment that has been approved by the manufacturer may be used in conjunction with site equipment. Pins that protrude from augers will not be allowed.

A variety of additional work practices (i.e., hoisting, cat line, pipe and auger handling, etc.) are to be adhered to by the drilling crew, but will not be addressed in this HSP. If the on-site field team leader or site supervisor observes any operations or actions that are perceived as threatening

to the health and safety of site personnel, drilling operations will be temporarily suspended until a mutual understand of the action(s) in question are addressed and/or corrected.

Soil borings have the potential for releases to the environment and exposure to personnel. Gases and vapors that have a vapor density of less than 1.0 are lighter-than-air and tend to migrate upward in the atmosphere and disperse (e.g., methane). Heavier-than-air gases and vapors tend to stay close to the ground and may migrate to low-lying areas (e.g., hydrogen sulfide). In general, the only containment for a release to the air is termination of the release at the source (e.g., plug the boring). Depending on the contaminant encountered, it may be necessary to evacuate persons who are downwind of the area of the release. Emergency response personnel should be notified (Section 13.6) if air concentrations at the perimeter of the exclusion zone exceed threshold limit values (TLVs) or permissible exposure limits (PELs).

### 11.3 HOUSEKEEPING

Housekeeping is a very important aspect of an investigation program and will be strongly stressed in all aspects of field work. Good housekeeping plays a key role in occupational health protection and is a way of preventing dispersion of dangerous contaminants. All work areas will be kept as clean as possible at all times and spills will be cleaned up immediately. Housekeeping will be the responsibility of all employees.

HydroGeoLogic will implement a housekeeping program for the field activities to minimize the spread of contamination beyond the work site. The program will include the following:

- Daily scheduling to police the area of debris including paper products, cans, and other materials brought on-site
- Changing of wash and rinse water for hands, face, and equipment as needed
- Periodic (daily minimum) removal of all garbage bags and containers used to dispose of food products, plastic inner gloves, and contaminated disposable clothing

### 11.4 WORK LIMITATIONS

All investigation activities will be performed during normal daylight hours.

### 11.5 CONFINED SPACE ENTRY

Site personnel are not to undertake any activity that could be considered a confined-space entry.

### 11.6 SPILL CONTAINMENT

The procedures defined in this section comprise the spill containment activities in place at the site.

- All drums and containers used during the cleanup will meet appropriate United Nations, OSHA, and EPA regulations for the waste that they will contain.
- Drums and containers will be inspected and their integrity ensured prior to being moved. Drums or containers that cannot be inspected before being moved because of storage conditions will be positioned in an accessible location and inspected prior to further handling.
- Operations on-site will be organized so as to minimize the amount of drum or container movement.
- Employees involved in the drum or container operations will be warned of the hazards associated with the containers.
- Where spills, leaks, or ruptures may occur, adequate quantities of spill containment equipment (absorbent, pillows, etc.) will be stationed in the immediate area. The spill containment program must be sufficient to contain and isolate the entire volume of hazardous substances being transferred.
- Drums or containers that cannot be moved without failure will be emptied into a sound container.
- Fire extinguishing equipment meeting 29 CFR Part 1910, Subpart L shall be on hand and ready for use to control fires.

### 12.0 SITE CONTROL

### 12.1 WORK ZONES

Each investigation location will be physically barricaded with rope flagging or caution tape to control entry to and exit from the area. These barricaded areas will be referred to as the exclusion zones. The exclusion zone will be identified by the site supervisor and consist of a 20-foot radius surrounding the drilling location. Each person leaving an exclusion zone will proceed directly to the decontamination zone, which will be located adjacent to the exclusion zone and identified by physical barriers. The decontamination zone will consist of a low-lying area covered with a plastic sheeting. At the completion of decontamination procedures at each location, the debris will be enclosed in the plastic sheeting and deposited into 55-gallon type 17 E/H drums for later disposal as identified in the WP and FSP. Only personnel who are cleared by the HydroGeoLogic field leader and SSO will be permitted in the exclusion zones and/or decontamination zones. Clearance for accessing these areas will only be given to personnel who meet the training and medical surveillance requirements of OSHA Standard 29 CFR 1910.120 and are wearing the appropriate PPE required for the work activity.

The support zone, where the administrative, communications, and other support services will be based, will be in a controlled area off the site or on the far end upwind of potential site contamination or areas of potential exposure. Only persons and equipment that are free of contamination will be permitted in the support zone.

### 12.2 ON-SITE/OFF-SITE COMMUNICATIONS

Communications will consist of a centrally located telephone within the designated support zone (i.e., trailer, office) in addition to a mobile phone stationed within the on-site vehicle utilized for transportation. Field personnel may also utilize telephones located at NAS Fort Worth JRB in emergency situations.

### 13.0 EMERGENCY RESPONSE

This HSP has been developed in an attempt to prevent the occurrence of situations that may jeopardize the health and safety of on-site personnel. However, supplemental emergency procedures must be identified in the event that an unforeseen health and safety accident or incident occurs. In general, HydroGeoLogic will evacuate their employees and subcontractors from the workplace if an emergency involving chemical spills, chemical fires, chemical exposure, and/or chemical emissions occurs. For this reason, emergency response planning will be in accordance with OSHA Standard 29 CFR 1910.38(a).

### 13.1 PREPLANNING

Upon initial arrival at the site, the HydroGeoLogic field leader and SSO will visit the base's fire department to determine the status of emergency response services. This meeting will include a determination as to the need for further coordination with local rescue and police services.

Another aspect of preplanning for emergencies includes completion of the Medical Data Sheet (Section 14.1). This sheet must be completed by all HydroGeoLogic personnel and subcontractors so that, in the event of personal injury or illness, the examining physician has background information readily available on the injured/ill party.

### 13.2 EMERGENCY PROCEDURES AND ASSIGNMENTS

Upon notification of a site emergency requiring evacuation, all HydroGeoLogic personnel and subcontractors will proceed directly to the support zone (i.e., trailer, office). If personnel cannot reach the support zone without endangering life or health, an alternate meeting point will be specified by the HydroGeoLogic SSO. Emergency egress routes and meeting points will be discussed at each daily health and safety briefing.

In the event of an emergency, the following procedures will be implemented:

- The site supervisor will evaluate the incident, assess the need for assistance, and call the appropriate contacts, if necessary.
- The site supervisor will act as the point of contact for outside emergency personnel and on-site personnel.
- The site supervisor will advise emergency response and emergency room personnel
  as to the types of contamination potentially contacted by injured workers receiving
  emergency care.
- The site supervisor will ensure that the SSO promptly notifies the HydroGeoLogic PM and HSO of the incident.

### 13.2.1 Chemical Inhalation

It is not anticipated that chemicals of concern will be present at the site in concentrations to cause immediate danger to life and health. However, any field personnel exhibiting or complaining of symptoms of chemical exposure as described in Section 4.1 will be removed from the work zone and transported to the designated medical facility for examination and treatment.

### 13.2.2 Eve and Skin Contact

Field personnel who have come into contact with contaminants while in the exclusion zone will proceed immediately to the decontamination zone, where an eye wash station will be located. At the eyewash station the following procedures will be followed:

- Do not decontaminate prior to using the eye wash
- Remove necessary PPE to perform the eye wash procedures
- Flush the eye with the clean water for at least 15 minutes
- Arrange for prompt transport to the designated medical facility

Unless skin contact with contaminants is severe, personnel should proceed through the decontamination zone. Field personnel should remove any contaminated PPE and wash the affected area for at least 15 minutes. If the personnel show signs of skin irritation, they will be transported to the designated medical facility.

### 13.3 PROCEDURES FOR PERSONNEL REMAINING ON-SITE

No HydroGeoLogic or subcontractor personnel will remain on-site to operate critical site emergency operations.

### 13.4 PROCEDURES TO ACCOUNT FOR SITE PERSONNEL

The HydroGeoLogic and subcontractor work force will be small enough so that accounting for site personnel will not be a problem. The HydroGeoLogic field leader and SSO will ensure that the whereabouts of all personnel are known.

### 13.5 RESCUE AND MEDICAL DUTIES

Only those persons who have been trained by the American Red Cross, or equivalent, will be permitted to perform rescue, first aid, and/or CPR treatment. Outside emergency services and medical facilities will be the primary providers of such services. At least one person who is currently certified in first aid and CPR will be on-site at all times during field activities. A "physicians-approved" first aid kit, an ANSI-approved eye wash station with 15-minutes of free-flowing freshwater, and a Class ABC fire extinguisher will be readily available on-site.

Any HydroGeoLogic employee who shows signs or symptoms of overexposure must immediately be examined by a licensed physician. Subcontractor personnel who show signs or symptoms of

overexposure will be encouraged to visit a licensed physician as well. Figure 13.1 describes the directions to the nearest medical facility.

### 13.6 EMERGENCY COMMUNICATION PROCEDURES, CONTACTS, AND PHONE NUMBERS

Persons who observe an emergency situation must immediately notify the HydroGeoLogic field leader and/or SSO. The field leader or SSO will then immediately assess the emergency and appoint someone to telephone appropriate outside emergency services and will coordinate site evacuation. Emergency telephone numbers and directions to the nearest medical facility are included as Table 13.1, a copy of which will be posted at the nearest telephone. In addition, Figure 13.1 illustrates the directions to the nearest medical facility.

### 13.7 ACCIDENT/INCIDENT FOLLOW-UP AND REPORTING

Upon receiving a report of an incident (or near-incident), the SSO shall immediately investigate the circumstances and make appropriate recommendations to prevent recurrence. The HSO shall also be immediately notified by telephone on occurrence of a serious accident or incident. The HSO, at their individual discretion, may also participate in the investigation.

Details of the incident shall be documented on the Accident/Incident/Near Miss Investigation form (Section 14.1) within 24 hours of the incident and shall be distributed to the PM, HSO, and COR. A copy of this report shall also be sent to the appropriate administrative contact for inclusion into the OSHA Form 101 and 200 log. Incident report forms will be available at site support facilities.

# 14.0 DOCUMENTATION AND EQUIPMENT

This section summarizes the documentation and equipment needs for the project as specified in the HSP. Its purpose is to serve as a partial checklist to help ensure all of the necessary resources are available to carry out the requirements of the HSP.

### 14.1 DOCUMENTATION AND FORMS

The following documents are presented in the following pages for use during site operations:

- Site Safety Briefing Form
- HSP Compliance Agreement Form
- HSP Amendments Form
- Accident/Incident/Near Miss Investigation Form
- Medical Data Sheet
- Daily Equipment Calibration Log
- Air Monitoring Log

In addition, the following documentation will be present on-site during site operations:

- Approved HSP (signed copy)
- OSHA poster
- MSDSs
- Employee training and medical surveillance certificates
- Subcontractor training and medical surveillance certificates

### 14.2 EMERGENCY HEALTH AND SAFETY EQUIPMENT

- First aid kit
- Eye wash
- Inner latex or vinyl gloves
- Outer nitrile gloves (disposable and 11 mil thick)
- Boot covers
- Hard hats and safety glasses
- Tyvek™ suits
- PVC and/or Saranex<sup>™</sup> suits (with hoods)
- Ear defenders/plugs
- Decontamination kit
- Fire extinguisher
- Fall protection devices (body harness and lanyard)
- Duct tape
- LEL/O<sub>2</sub> meter
- PID

The site supervisor and/or SSO shall be responsible for maintaining first aid kits and fire extinguishers at each site where field activities are taking place. The location of first aid kits and fire extinguishers will be discussed during each daily health and safety meeting.

### 15.0 REFERENCES

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- NIOSH/OSHA/USCG/EPA, October 1985, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, (DHHS (NIOSH) Publication No. 85-115); EPA, June 1992, Standard Operating Safety Guides, (NTIS Publication No. 9285.1-03).
- Occupational Safety and Health Administration (OSHA) General Industry Standards, 29 CFR 1910, and Construction Industry Standards, 29 CFR 1926; especially 29 CFR 1910.120/29 CFR 1926.65, Hazardous Waste Site Operations and Emergency Response.
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- U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health (NIOSH), June 1997, Pocket Guide to Chemical Hazards.

# TAB

Tables

Table 4.1 Exposure Limits and Recognition Qualities

	Permissible		Recogn	Recognition Qualities	s	Odor Warning			Ionization
Compound	Exposure Limit (PEL)*	IDLH Level <sup>b</sup>	Color	Odor	State	Concentration (ppm)	LEL <sup>c</sup> (%)	UEL4 (%)	Potential (eV)
Anthracene	See coal tar pitch volatiles								
Arsenic Compounds	0.010 mg/m³	5 mg/m³*	Silver gray to tin-white	Odorless	Solid	NA	NA	NA	NA
Benzene	1.0 ррт	500 ppm²	Colorless to light yellow	Aromatic	Lıquid	1.5 - 5.0	1.2	7.8	9.24
Benzo[a]anthracene	See coal tar pitch volatiles								
Benzo[b]fluoranthene	See coal tar pitch volatiles								
Benzo[k]fluoranthene	See coal tar pitch volatiles								
Benzo[ghi]perylene	See coal tar prtch volatiles								
Benzo[a]pyrene	See coal tar pitch volatiles								
bis(2-Ethylhexyl)phthalate	5 mg/m³	5,000 mg/m³e	Colorless	Slight	Liquid	NA	0.3	NA	NA
2-Butanone (MEK)	200 ррт	3,000 ррт	Colorless	Sharp, mint-lıke	Liquid	ΩN	1.4	11.4	9 54
Cadmium	0 005 mg/m³	9 mg/m³€	Blush-silver	N/A	Metal	NA	NA	N/A	NA
Chloroethane	1,000 ррш	3,800 ррт	Colorless	Ether-like	Liquid or gas	NA	3.8	15.4	10.97
Chrysene	See coal tar pitch volatiles								
Coal tar pitch volatiles	0.2 mg/m³	80 mg/m³∗	Black or brown	None	Solid	NA	NA	NA	NA
1,1-Dichloroethane	100 ррт	3,000 ррш	Colorless	Chlorofor m-like	Lıquıd	NA	5.4	11 4	11.06

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Table 4.1 (continued)
Exposure Limits and Recognition Qualities

99	Permissible	, , , , , , , , , , , , , , , , , , ,	Recognit	Recognition Qualities	o o o o o o o o o o o o o o o o o o o	2-8,2 ×	2 47%		Ionization
· Compound	Exposure Control Limit (PEL)	DLH	Color	. Odor	State	Concentration (ppm)	x * x	(%)	Forential (eV)
1,1-Dichloroethene	QN	,QN	Coloriess	Chlorofor m-11ke	Liquid or gas	50	6.5	15.5	10.00
1,2-Dichloroethene	200 ppm	1000 ppm	Colorless	Slightly acrid, chlorofor m-like	Liquid	17.0	5.6	12.8	9.65
Ethylbenzene	100 ppm	800 pp.m	Colorless	aromatic	Lıquıd	4.7 - 5.0	0.8	6.7	8.76
Ethylene dibromide	20 ppm	100 ррт	Colorless	Sweet	Liquid	ND	NA	NA	9 45
Fluoranthene	See coal tar pitch volatiles								
Freon 113	1,000 ppm	2,000 ppm	Colorless to water-white	Ether-like	Liquid or gas	ND	NA	NA	11 99
Gasoline	QN.	ND¢	Clear	Gasoline	Liquid	ND	1.4	7.6	ND
Hexane	500 ppm	1,100 ррт	Colorless	Gasolme- like	Liquid	NA	1.1	7.5	10.18
Hydrochloric Acid	C 5 ppm	20 ppm	Colorless to light yellow	Irritating	Gas	NA	NA	NA	12.74
Indeno[1,2,3-cd]pyrene	See coal tar pitch volatiles								
Jet Fuel (JP-4)	QN	ND	Tea-brown	Gasoline	Liquid	QN	ND (flammable)	ND (flammable)	ND
Lead	0.050 mg/m³	100 mg/m <sup>3</sup>	Gray	Odorless	Solid	NA	NA	NA	NA
Mercury	0.100 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>	Silver-white	Odorless	Liquid	NA	NA	NA	NA
Methanol	200 ppm	900 ррт	Colorless	Pungent	Liquid	100	6.0	36.0	10 84
Naph Tene	10 ppm	250 ppm	Colorless to brown	Mothballs	Solid	ND	6.0	5.9	8.12

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Table 4.1 (continued)

Exposure Limits and Recognition Qualities

	Permissible		Recogni	Recognition Qualities		Odor Warning	3 1 21 1	TIET	Ionization 7
Compound	Exposure Limit (PEL)*	IDLH Level <sup>b</sup>	Color	Odor	State	(bpm)	(%)	(%)	(eV)
Nitric Acid	2 ppm	25 ppm	Colorlessred or yellow	Acrid, suffocating	Lıquıd	NA	NA	NA	11.95
Phenanthrene	See coal tar pitch volatiles								
Pyrene	See coal tar pitch volatiles								
Sulfuric Acid	1 mg/m³	15 mg/m³	Colorless, yellow, or brown	Odorless	Solution	NA	NA	NA	ON
1,1,1,2-Tetrachloroethane	QN	ND	Yellowish-red	None	Liquid	NA	NA	NA	NA
1, 1, 2, 2-Tetrachloroethane	lppm [skin]	100 ppm°	Colorless to pale yellow	Pungent, chlorofor m-like	Liquid	Ð	NA	NA	11.10
Tetrachloroethene	100 ppm <sup>f</sup>	150 ppm°	Coloriess	Chlorofor m-like	Liquid	27.0	NA	NA	9.32
Toluene	200 ppm	500 ppm	Colorless	Aromatic	Liquid	0,17 - 40	1.1	7.1	8.82
1,1,1-Trchloroethane	350 ppm	700 mgd	Colorless	Mild, chlorofor m-like	Liquid	ON	7.5%	12 5%	11.00
1,1,2.Trichloroethane	10 ppm	100 ppm°	Colorless	Sweet, chlorofor m-like	Liquid	Ø.	9	15.5	11.00
Trichloroethene	100 ppm²	1,000 ppm <sup>e</sup>	Colorless	Chlorofor m-like	Liquid	28 0	8.0	10.5	9.45

**Exposure Limits and Recognition Qualities** Table 4.1 (continued)

	Permissible	X X X X X X X X X X X X X X X X X X X		Recognition Qualities	× ~ ^ < ×	Odor Warning			Ionization
E. Compound	Exposure Limit (PEL)		Color	Ödor	State	Concentration:	<b></b> ( ×	.EL	Potential :
Vınyl Chloride	I ppm	ND¢	Colorless	Pleasant	Liquid or gas	3,000	3.6	33	9.99
Xylenes (total)	100 ррт	900 ppm	Colorless	Aromatic Liquid	Lıquid	1.0 - 1 5	1.1	7.0	8.56

OSHA permissible exposure limit or the American Conference of Governmental Industrial Hygienists' threshold limit value (both 8-hour time weighted averages). Immediately dangerous to life or health

Lower explosive limit.

Upper explosive limit.

To be treated as a carcinogen
The value presented is the OSHA PEL, which is not necessarily the most conservative of the available exposure limits The air monitoring screening levels in Table 61 are based upon the

most conservative values

Ceiling value, a 15-minute Time Weighted Average that shall not be exceeded at any time during the work day Electron volts. C mg/m³ ND ND ppm

Milligrams per cubic meter. Not applicable

Parts per million. Not determined

Sources:

NIOSH, 1997 Dràger, 1989

Table 4.2
Acute and Chronic Effects
Symptoms of Overexposure and First Aid Treatment

Compound	Symptoms of Overexposure		First Aid Treatment
Anthracene	See coal tar pitch volatiles		
Arsenic	Ulceration of rasal septum; dermatitis; gastrointestinal disturbances; peripheral neuropathy; respiratory irritation, hyperpigmentation of skin; carcinogen	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately (15 min) Soap wash immediately Not an inhalation hazard Medial attention immediately
Benzene	Irritation to eyes, nose, respiratory systems; giddiness; headache, nausea, staggered gait; fatigue, anorexia, lassitude; dermatitis; bone marrow depressant/depression; carcinogenic	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Soap wash promptly Artificial respiration Medical attention immediately: DO NOT INDUCE VOMITING
Benzo[a]anthracene	See coal tar pitch volatiles		
Benzo[b]fluoranthene	See coal tar pitch volatiles		
Benzo[k]fluoranthene	See coal tar pitch volatiles		
Benzo[ght]perylene	See coal tar pitch volatiles		
Benzo[a]pyrene	See coal tar pitch volatiles		
bıs(2-Ethylhexyl)phthalate	Irritation of eyes, mucous membranes; carcinogen	Eye: Skin Inhalation: Ingestion:	Irrigate immediately Not a dermal hazard Respiratory support Medical attention immediately
2-Butanone (MEK)	Irritating to eyes and nose; headache, dizziness; vomiting	Eye: Skin. Inhalation: Ingestion:	Irrigate immediately Water wash immediately Move to fresh air; respiratory support Medical attention immediately
Садтит	Pulmonary edema, dyspnea, coughing, chest ughtness, substernal pain; headache; chills, muscle pain; nausea, vomitng, darrhea, anosma, emphysema, protemura, mild anemia; carcinogemc	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Soap wash immediately Move to fresh air; respiratory support Medical attention immediately

Table 4.2 (continued)
Acute and Chronic Effects
Symptoms of Overexposure and First Aid Treatment

Compound	Symptoms of Overexposure	, , , , , , , , , , , , , , , , , , ,	First Aid Treatment	
Chloroethane	Incoordination, inebriate; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver and kidney damage	Eyer Skin: Inhalation: Ingestion:	Irrigate ummediately Water flush promptly Respiratory support Medical attention immediately	
Chrysene	See coal tar pitch volatiles			
Coal tar pitch volatiles	Dermatitis, bronchitis, carcinogenic	Eye: Skın: Inhalation: Ingestion:	Irrigate immediately Soap wash immediately Move to fresh air; respiratory support Medical attention immediately	
1,1-Dichloroethane	Central nervous system depressant; skin irritant; liver and kidney damage	Eye: Skın: Inhalatıon. Ingestion:	Irrigate immediately Soap flush promptly Respiratory support Medical attention immediately	
1,1-Dichloroethene	Irritation to eyes, skin, and throat; dizziness, headache, and nausea; breathing difficulty; liver and kidney dysfunction; pneumonitis; carcinogen	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Water flush immediately Move to fresh air, respiratory support Medical attention immediately	
1,2-Dichloroethene	Irritation of eyes and respiratory system; central nervous system depressant/depression	Eye: Skın <sup>.</sup> Inhalation <sup>.</sup> Ingestion:	Irrigate immediately Soap wash promptly Respiratory support Medical attention immediately	
Ethylbenzene	Irritation to eyes, mucous membranes; headache; dermatitis; narcosis; coma	Eye: Skın: Inhalatıon: Ingestion	Irrigate immediately Soap wash promptly Artificial respiration Medical attention immediately	
Ethylene dibromide	Irritation to eyes, skin, respiratory system; dermatitis with vesiculation; liver, heart, spleen, kidney damage; reproductive effects; carcinogen	Eye: Skin. Inhalatıon <sup>.</sup> Ingestion:	Irrigate immediately Soap wash immediately Move to fresh air; respiratory support Medical attention immediately	
Fluoranthene	See coal tar pitch volatiles			

# Table 4.2 (continued) Acute and Chronic Effects Symptoms of Overexposure and First Aid Treatment

Compound	Symptoms of Overexposure		First Aid Treatment
Freon 113	Irritation of skin, throat; drowsiness, dermatitis; central nervous system depression	Eye: Skın: Inhalation: Ingestion:	Irrigate immediately Soap wash promptly Respiratory support Medical attention immediately
Gasoline	Irritation to eyes, skin, mucous membranes; dermatitis, headaches, fatigue, blurred vision, dizziness, slurred speech, confusion, convulsions, chemical pneumonia (aspiration); possible liver, kidney damage; carcinogen	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Soap flush immediately Respiratory support Medical attention immediately
Hexane	Light-headedness, nausea, headaches, numbness in extremities, weak muscles, eye irritation, nose irritation, dermattis, chemical pneumonia, giddiness	Eyer Skin: Inhalation Ingestion:	Irrigate immediately Soap, wash immediately Respiratory support Medical attention immediately
Hydrochloric Acıd	Inflammation of the nose, throat, laryngeal; cough, burns throat, choking; burns eyes, skin, dermatitis	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Water flush immediately Respiratory support Medical attention immediately
Indeno(1,2,3-cd)pyrene	See coal tar pitch volatiles		
Jc fuel (JP-4)	Irritation to eyes, skin, and mucous membranes; dermatitis; headaches, narcosis, coma	Eyer Skin: Inhalation: Ingestion:	Irrigate immediately Soap wash promptly Move to fresh air, respiratory support Medical attention immediately
Lead	Weak, lassitude, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremors; paralysis of wrist and ankles; encephalaopathy; nephropathy; irritation to eyes; hypotension	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Soap wash promptly Respiratory support Medical attention immediately
Mercury	Cough, chest pain, dyspnea, bronchitts pneumonius; tremors, insomnia; irritability, indecision; headache, fatigue, weak; stomatitis, salivation, gastrointestinal disturbance, anorexia, weight loss; proteinuria; irritation of the eyes, skin	Eye: Skin: Inhalation. Ingestion:	Irrigate immediately Soap wash promptly Respiratory support Medical attention immediately
Methanol	Eye ırritant, headache, drowsıness, lightheadedness, nausea, vomiting, visual disturbances, blındness	Eye: Skin: Inhalation: Ingestion	Irrigate immediately Water flush immediately Respiratory support Medical attention immediately

# Table 4.2 (continued) Acute and Chronic Effects Symptoms of Overexposure and First Aid Treatment

Compound SE	Section of the section of contractions of cont	*	First Aid Treatment
Napthalene	Eye irritation, headache, confusion, excitement, malaise; nausea, vomiting, abdominal pain; irritated bladder; profuse sweating; jaundice; blood in urine; hemoglobinuria; renal shutdown; dermatitis; optical neuritis, cornea damage	Eye: Skin: Inhalation: Ingestion:	Irrigate mmediately Soap wash promptly Move to fresh air, respiratory support Medical attention immediately
Nitric Acid	Irritation of eyes, mucous membranes, and skin; delayed pulmonary edema, pneutis, bronchitis; dental erosion	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Water flush immediately Respiratory support Medical attention immediately
Phenanthrene	See coal tar pitch volatiles		
Pyrene	See coal tar pitch volatiles		
Sulfunc Acid	Irritation to eyes, nose, and throat; pulmonary edema; bronchitis; emphysema, conjunctivitis, stomitis; dental erosion; thracheobronchitis, eye and skin burns, dermaitus	Eye: Skin. Inhalation Ingestion	Irrigate immediately Water flush immediately Move to fresh air; respiratory support Medical attention immediately
1,1,1,2-Tetrachloroethane	Irritated eyes, skin; weakness, restlessness, ırregular respıration, muscle ıncoordination	Eye: Skin. Inhalation: Ingestion:	Irrigate immediately Soap wash immediately Respiratory support Medical attention immediately
1,1,2,2-Tetrachloroethane	Nausea, vomiting, abdominal pain; tremor fingers, jaundice, hepatitis, liver tenderness; dermatitis; monocytosis; kidney damage; carcinogen	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Soap wash promptly Respiratory support Medical attention immediately
Tetrachloroethene	Irritation of the eyes, nose, throat, nausea; flush face, neck; vertigo, dizziness, in coordination; headache, somnolence; skin erythema; liver damage; carcinogen	Eye: Skin: Inhalation: Ingestion.	Irrigate immediately Soap wash promptly Respiratory support Medical attention immediately
Toluene	Fatigue, weakness; confusion, euphoria, dizziness, headache; dilated pupils, lacrimation; nervousness, muscle fatigue, insomnia, paresis; dermatitis	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Soap wash promptly Move to fresh air Medical attention immediately; DO NOT INDUCE VOMITING

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Table 4.2 (continued)
Acute and Chronic Effects
Symptoms of Overexposure and First Aid Treatment

Compound	Symptoms of Overexposure		First Aid Treatment
1,1,1-Trichloroethane	Irritation to eyes, skin; head, weakness, exhaustion, central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmia, liver damage	Eye · Skin: Inhalation Ingestion:	Irrigate immediately Soap wash promptly Respiratory support Medical attention immediately
1,1,2-Trichloroethane	Irritation to eyes and nose; central nervous system depression; liver and kidney damage, dermatitis; carcinogenic	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Soap wash promptly Move to fresh air; respiratory support Medical attention immediately
Trichloroethene	Headache, vertigo; visual disturbance, tremors, somnolence, nausea, vomiting; irritation of the eyes; dermatitis; cardia arrhythmias, paresthesia; carcinogen	Eye: Skin: Inhalation: Ingestion	Irrigate immediately Soap wash promptly Respiratory support Medical attention immediately
Vinyl Chloride	Weakness, abdominal pain, gastrointestinal bleeding; hepatomegaly; pallor or cyan of extremities; carcinogen	Inhalation:	Respiratory support
Xylenes (total)	Dizziness, excitement, drowsiness, in coordination, staggering gait; irritation of eyes, nose, throat; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eye: Skin: Inhalation: Ingestion:	Irrigate immediately Soap wash promptly Move to fresh air Medical attention immediately; DO NOT INDUCE VOMITING

Source: NIOSH, 1997

#### Table 4.3 Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers

Adjusted Temperature <sup>1</sup>	Normal Work Ensemble <sup>2</sup>	Impermeable Ensemble
90 °F or above	After each 45 minutes of work	After each 15 minutes of work
87.5 °F - 90 °F	After each 60 minutes of work	After each 30 minutes of work
82.5 °F - 87.5 °F	After each 90 minutes of work	After each 60 minutes of work
77 5 °F - 82.5 °F	After each 120 minutes of work	After each 90 minutes of work
72.5 °F - 77.5 °F	After each 150 minutes of work	After each 120 minutes of work

<sup>&</sup>lt;sup>1</sup>Calculate the adjusted air temperature  $(T_{sj})$  by using the equation:  $T_{sj}$  (°F) = T (°F) + (13 x % sunshine). Measure air temperature (T) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow (100 percent sunshine = no cloud cover and a sharp, distinct shadow, 0 percent sunshine = no shadows)

A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants

Source NIOSH/OSHA/USCG/EPA, 1985.

# Table 6.1 Hazard Monitoring Methods, Action Levels, and Protection Measures

Hazard	Monitoring Method	Action Level	Protective Measures	Monitoring Schedule
Toxic Vapors (as identified in Table	PID	0 0 to < 0.5 ppm above background based on judgment of SSO	Level D (see Table 7.1)	-continue with regular monitoring of breathing zone
4.1)		0.5 ppm above background based on judgment of SSO	Level D (see Table 7.1)	-confirm/deny reading with vinyl chloride and benzene colorimetric tubes
				-if confirmed as vinyl chloride and/or benzene, then see vnnyl chloride/benzene hazard identified below
				-if denied as vinyl chloride and benzene, then continue with regular monitoring of breathing zone
		≥0 5 ppm to <25 ppm above background based on judgment of SSO (if denied as vmvl chloride and henzene)	Level D (see Table 7.1)	-confirm/deny reading with vinyl chloride and benzene colorimetric tubes
				-if confirmed as vinyl chloride and/or benzene, then see vinyl chloride/benzene hazard identified below
				-if denied as vinyl chloride and benzene, then continue with regular monitoring of breathing zone
				-confirm/deny reading with tetrachloroethene and TCE colorimetric tubes
				-if confirmed, then see hazard identified below
				-if denied as tetrachloroethene or TCE, then continue with regular monitoring of breathing zone
		>25 to <250 ppm above background based on indement of SSO (if denied as viny)	Level C (see Table 7.1)	-continue with regular monitoring of breathing zone
		chloride, benzene, and tetrachloroethene)		- contact HSO and Project Manager
				- continue use of tubes, attempt to identify unknown air contaminants
Vınyl Chloride	Colorimetric Tubes	confirmed 1.0 ppm to 10 ppm above background based on Judgment of SSO	Level C (See Table 7.1)	-continue regular monitoring of breathing zone
Вепzепе	Colorimetric Tubes	confirmed 0.5 ppm to 5 ppm above background based on judgment of SSO	Level C (See Table 7.1)	-continue regular monitoring of breathing zone

Table 6.1 (continued)
Hazard Monitoring Methods, Action Levels,
and Protection Measures

Hazard	Monitoring Method	Action Level	Protective Measures	Wonitoring Schedule.
Tetrachloroethene	Colorimetric Tubes	confirmed 25 ppm to 250 ppm above background based on judgment of SSO	Level C (See Table 7.1)	-continue regular monitoring of breathing zone
Trichloroethene	Colorimetric Tubes	confirmed 50 ppm to 500 ppm above background based on judgment of SSO	Level C (See Table 7.1)	-continue regular monitoring of breathing zone
Flammable/Explosive Gases and/or Vapors	LEL/O, Detector	0.0 to 5.0 percent LEL	-notify sampling team of readings	-prior to and during sampling activities, monitor all areas suspected of containing flammable/explosive gases and/or vapors -continue with regular monitoring of breathing zone
		5.0 to <10 0 percent LEL	-use spark proof equipment/tools	-continue with regular monitoring of breathing zone - notify HSO and Project Manager
		> 10 0 percent LEL	STOP WORK, EVACUATE AREA, NOTIFY PROIECT MANAGER	-requires HSP amendments unless readings subside
Toxic Vapors (as identified in Table 4.1)	PID	>250 above background based on judgment of SSO (if denied as all chemicals listed above)	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	-requires identification of new chemical hazard and HSP amendments
Vinyl Chloride	Colorimetric Tubes	confirmed 10 ppm or greater above background based on judgment of SSO	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	- requires HSP amendments
Benzene	Colorimetric Tubes	confirmed 5 ppm or greater above background based on judgment of SSO	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	-requires HSP amendments

Table 6.1 (continued)
Hazard Monitoring Methods, Action Levels,
and Protection Measures

	Monitoring			
Hazard	Method	Action Level	Protective Measures	Monitoring Schedule
Tetrachloroethene	Colorimetric Tubes	confirmed 250 ppm or greater above background based on judgment of SSO	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	-requires HSP amendments
Trichloroethene	Colorimetric Tubes	confirmed 500 ppm or greater above background based on judgment of SSO	STOP WORK, EVACUATE AREA, NOTIFY PROJECT MANAGER	- requires HSP amendments

Table 7.1
Protective Equipment for On-site Activities

Activity	Level	Protective Equipment
Surface Soil Sampling Subsurface Soil Sampling Groundwater Sampling	D	<ul> <li>Street clothes or overalls (long sleeves)</li> <li>Impermeable safety boots/shoes (steel-toed)</li> <li>Safety glasses/goggles (if hazard to eyes exists)</li> <li>Hard hat (if hazard to head exists)</li> <li>Gloves (nitrile, neoprene)</li> <li>Ear plugs/defenders (if hazard exists)</li> </ul>
	D (modified)	<ul> <li>Rubber boots; chemically-resistant with steel toe</li> <li>Gloves (nitrile, neoprene)</li> <li>Tape for sealing ankle and wrist openings</li> <li>Hard hat (if hazard to head exists)</li> <li>Safety glasses/goggles (if hazard to eyes exists)</li> <li>Unbolted Tyvek™ or equivalent</li> <li>Ear plugs/defenders (if hazard exists)</li> </ul>
	С	<ul> <li>Coated Tyvek™ or equivalent</li> <li>Rubber boots; chemically resistant with steel toe</li> <li>Rubber boot covers</li> <li>Latex inner gloves</li> <li>Tape for sealing ankle and wrist openings</li> <li>Chemical resistant outer gloves (nitrile, neoprene)</li> <li>Full-face respirator (organic vapor cartridges)</li> <li>Additional items may be required (site-specific)</li> <li>Ear plugs/defenders (if hazard exists)</li> </ul>

Table 8.1
Six Stages for Decontamination in Modified Level D Protection

	Stage	Procedure
Stage 1:	Segregated Equipment Drop	Deposit equipment used on-site on plastic drop cloths or in assigned containers with plastic liners.
Stage 2:	Boot Cover and Glove Wash	Scrub outer boot covers and gloves with decontamination solution, and rinse with water.
Stage 3:	Tape Removal	Remove tape around boots and gloves and deposit in container with plastic liner.
Stage 4:	Remove boots, gloves, and disposable clothing	Deposit in appropriate plastic-lined container. Discard disposable clothing.
Stage 5:	Field wash	Wash hands and face with soap and water.
Stage 6:	Redress	Put on clean clothes.

**Table 8.2** Eighteen Stages for Decontamination in Level C Protection

	Stage	Procedure
Stage 1:	Segregated Equipment Drop	Deposit equipment used on-site on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross-contamination. During hot weather operations, a cool-down station may be set up within this area.
Stage 2:	Boot Cover and Glove Wash	Scrub outer boot covers and gloves with decon solution of detergent and water.
Stage 3.	Boot Cover and Glove Rinse	Rinse off decon solution from Stage 2 using copious amounts of water.
Stage 4:	Tape Removal	Remove tape around boots and gloves and deposit in container with plastic liner.
Stage 5:	Boot Cover Removal	Remove boot covers and deposit in container with plastic liner.
Stage 6:	Outer Glove Removal	Remove outer gloves and deposit in container with plastic liner.
Stage 7:	Suit, Glove, and Boot Wash	Wash splash suit, gloves, and safety boots. Scrub with long-handle scrub brush and decon solution.
Stage 8:	Suit, Glove and Boot Rinse	Rinse off decon solution using water. Repeat as many times as necessary.
Stage 9.	Canister or Mask Change	Perform last step in the decontamination procedure (if worker is leaving exclusion zone to change canister or mask). Worker's canister is exchanged, new outer gloves and boot covers donned, and joints taped; worker returns to duty.
Stage 10:	Safety Boot Removal	Remove safety boots and deposit in container with plastic liner.
Stage 11:	Splash Suit Removal	Remove splash suit with assistance of helper. Deposit in container with plastic liner.
Stage 12:	Inner Glove Wash	Wash inner gloves with decon solution.
Stage 13.	Inner Glove Rinse	Rinse inner gloves with water.

### Table 8.2 (continued) Eighteen Stages for Decontamination in Level C Protection

* *{**********************************	Stage (10)	Procedure
Stage 14:	Face Piece Removal	Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers. Note: Certain parts of contaminated respirators, such as the harness assembly and leather or cloth components are difficult to decontaminate. If grossly contaminated, they may need to be discarded. Rubber components can be soaked in soap and water and scrubbed with a brush. Use a final rinse of water and allow to air dry before using again. Inspect the respirator for damage and signs of wear before and after each use.
Stage 15:	Inner Glove Removal	Remove inner gloves and deposit in lined container.
Stage 16:	Inner Clothing Removal	Remove clothing soaked with perspiration and place in lined container. Do not wear inner clothing off the site since there is a possibility that small amounts of contaminants might have been transferred when removing the disposal coveralls.
Stage 17	Field Wash	Shower if highly toxic, skin-corrosive, or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.
Stage 18:	Redress	Put on clean clothes.

# Table 13.1 Emergency Telephone Numbers, Contacts, and Directions to Nearest Medical Facility

Key Personnel	Number
Lynn Morgan - Project Manager	(703) 736-4511
Ken Rapuano - Health and Safety Officer	(703) 736-4546
Jım Costello - Program Manager	(703) 736-4507
Michael Dodyk - Base Point of Contact (AFCEE/ERD)	(817) 732-7167
Don Ficklen - AFCEE/ERD Contracting Officer's Representative	(210) 536-5290
Emergency Phones Numbers	
Ambulance	911 or (817) 782-6330
Fire Department	911 or (817) 782-6330
Poison Control	911 or (800) 441-0040
Hospital - Harris Methodist - Fort Worth	911 or (817) 882-2000
1301 Pennsylvania Avenue	
Note: When using a cellular phone call (817) 782-6330 for ambulance	
and fire response. If this number is busy or not available - 911 should be	
dialed and an operator will transfer the call to the Naval Air Station's	
emergency phone line.	

#### Directions to Nearest Medical Facility (Figure 13.1)

Exit NAS Fort Worth JRB on Pumphrey Rd. heading south. Turn left on Roaring Springs Rd heading southeast for 2.0 miles. Roaring Springs Rd turns into Horne St. prior to I-30. Turn left on I-30 heading east for 4.0 miles. Turn right on Summit Ave. heading south for 0.3 miles. Turn left on Pennsylvania Ave. heading east for 0.2 miles. Turn right on South Lake St. heading south to 1301 Pennsylvania Ave. Emergency entrance is located on the right

# TAB

Figures

# TAB

Appendix A

#### APPENDIX A

AOC 17, 18, 19 IDENTIFICATION LETTER; CARSWELL AFB HAZARDOUS WASTE PERMIT NO. HW-50289; TNRCC LETTER DATED APRIL 22, 1994; and TNRCC LETTER DATED MARCH 2, 1995



February 17, 1998

AFCEE/ERD Attn. Mr. Joseph Dunkle 3207 North Road Brooks Air Force Base, Texas 78235-5363

Re: Contract No. F41624-95-D-8005-0005

Identification of Possible SWMUs at NAS Fort Worth JRB

Dear Mr. Dunkle:

The purpose of this letter is to notify you of the possibility of three additional sites at Naval Air Station Fort Worth Joint Reserve Base (NAS Fort Worth JRB) - two fire training areas and a landfill. We identified these possible sites during our review of aerial photographs for our ongoing Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) activities at the base. Our findings are summarized below with the supporting visual evidence provided in Figures 1 through 9. A base map is provided as Figure 10 showing the location of these sites based on the current configuration of the Base

#### Suspected Fire Training Area A

On April 10, 1952 (Figure 1), just north of Phillips Circle and south of Hobby Shop Road, is a single plane located on what appears to be open ground. The area directly beneath the plane is dark in color while the perimeter of the area appears white. This discoloration could be the result of charring from fire training exercises.

The time period at which this area may have been used as a fire training area is unknown. A review of aerial photographs, however, before and after 1952 indicates this site existed as early as December 31, 1950 (Figure 2) and no later than January 4, 1953 (Figure 3). No planes were visible in this area as early as September 1946. Figure 2 shows two airplanes located at the site in question. The second plane is located just west of the plane identified in Figure 1. The area beneath each of these planes shows a slight discoloration (darkening) indicating the possibility of fire training exercises. The area outside the adjacent perimeter of the suspected fire training area appears white in color. Figure 3 no longer shows any visible evidence of using this site as a fire training area, and the planes are no longer located at this site. In addition, the land appears to have been re-engineered, potentially for future construction activities. Figure 4 indicates that by February 1954, a parking area had been constructed over the site.

J. Dunkle (Page 2) February 17, 1998

#### Suspected Fire Training Area B

A single plane located in a cleared triangular shaped area south of taxiway Charlie and east of taxiway 35R was identified from a December 3, 1958 (Figure 5) aerial photograph of the base. The plane is parked on what appears to be open ground. The two planes located immediately southwest of this plane are parked in the area of SWMU 18 (Fire Training Area 1). Because the single plane is located at a distance from taxiway Charlie, we suspect that this area may have served as a fire training area similar to the adjacent site located immediately southwest.

Although the time period at which this area may have been used as a possible fire training area is unknown, it did not exist on February 3, 1954 (Figure 6) and is no longer visible after August 22, 1962 (Figure 7). Aerial photographs later than 1954 and earlier than 1962 were not available for this review to further quantify the time period at which a plane(s) may have been located at this site.

#### Suspected Landfill A

On April 10, 1942, just west of the most western section of the West Fork Trinity River (prior to rerouting the river), are 8-10 trench like areas (Figure 8). These trenches are located approximately 290 feet from the roadway that runs in a north-south direction along the eastern part of the base boundary. Each "trench" is estimated to occupy an area approximately 65 feet long by 35 feet wide. The trenches are oriented in an northeast-southwest direction. Combined, the trenches occupy an area of about 30,000 ft<sup>2</sup>, or 0.69 acres. Trenches like these were often used by the military for the burial of facility refuse ranging from construction debris to industrial waste. Other base landfills were located along the river, east of this site, during the late 1940s, 1950s, 1970s, and 1980s (e.g., SWMU Nos. 28 and 30).

On April 4, 1944, (Figure 9) there is no longer any visual evidence of the trenches at this location. The area appears to have been leveled and covered with grass. In 1997, it appears that a building is being constructed over the suspected site.

Please contact me at 703-736-4507, if there is anything else we can do for you regarding these possible sites.

Sincerely,

James P. Costello, P.G.

Project Manager

Attachments (Figures 1-10)

#### Location of Suspected Fire Training Area A



Drawn/Scanned by:
C. Farmer

Checked by:
M. Rodtang

Date: 12/31/97

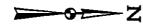
Date: 01/08/98

Filename: AFCEE\NAS\_FW\_JRB\FTA\

FTA\_fig1.cdr

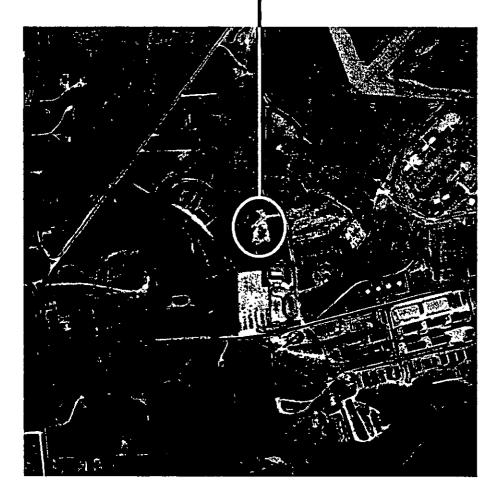


Figure 1
Aerial Photograph
April 10, 1952



Approximate Scale 1:8,500

## Location of Suspected Fire Training Area A



Drawn/Scanned by:
C. Farmer

Checked by:
M. Rodtang

Date: 01/08/98

Filename+AFCEE\NAS\_FW\_JRB\FTA\

FTA\_fig2.cdr

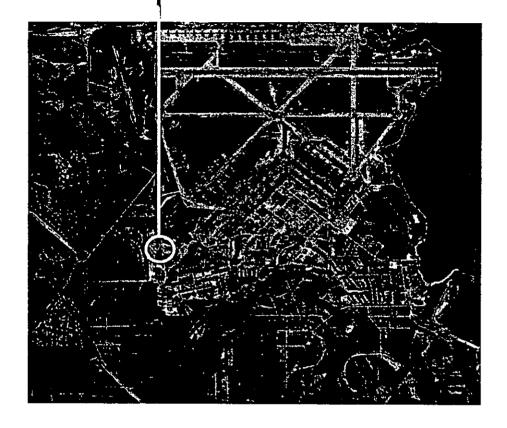


Figure 2 Aerial Photograph December 31, 1950

5 -0 Z

Approximate Scale 1:10,000

# Former Location of Suspected Fire Training Area A



Drawn/Scanned by:
C. Farmer

Checked by:
M. Rodtang

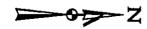
Date: 12/31/97

Date: 01/08/98

Filename-AFCEE\NAS\_FW\_JRB\FTA\
FTA\_fig3.cdr



Figure 3 Aerial Photograph January 4, 1953



Approximate Scale ~1:17,000

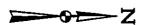
## Former Location of Suspected \_ Fire Training Area A



Drawn/Scanned by:
C. Farmer
Checked by:
M. Rodtang
Date: 01/08/98
Filename: AFCEE\NAS\_FW\_JRB\FTA\
FTA\_fig4.cdr



Figure 4 Aerial Photograph February 3, 1954



Approximate Scale 1:12,000

# RESPONSES TO COMMENTS: INTERNAL DRAFT WORK PLANS RCRA FACILITY INVESTIGATION OF SWMUs 19, 20, 21, 53; AND SITE INVESTIGATION OF AOCs 17, 18, AND 19 NAS FORT WORTH JRB, TEXAS

#### **Responses to Comments from UNITEC**

#### Work Plan

Comment 1

Page 1, Section 1.1. Background Section: It is stated that in addition to the RFI, a SI will be conducted at AOCs 17, 18, and 19. These sites were added to the list by the Air Force in 1999. Please list the reference letter or document by which these sites were added to the list of AOCs and add the letter to Appendix A.

Response

AOCs 17, 18, and 19 were identified to the Air Force in a letter from HydroGeoLogic with attachments submitted in February 1998. This letter has been included as a reference in Section 8.0 and as an attachment in Appendix A. Although AOCs 17, 18, and 19 were presented to the TNRCC in a RAB meeting following the submittal of the letter, no formal correspondence was submitted to the TNRCC regarding these AOCs.

Comment 2

Figure 1.6. It is recommended that the photo in the upper right hand corner of the figure be removed.

Response

Historic photographs of the site, when available, were included in Section 1.0 figures in order to illustrate earlier site conditions. Photo B in Figure 1.6 illustrates SWMU 53 before the new concrete head wall and concrete ditch were constructed. This area is of particular concern due to unidentified waste materials found in the soil during the construction of the concrete drainage ditch in 1993.

**Comment 3** 

In Figure 1.7, illustrating the historic location of AOC 17, it is recommended that a North arrow be included to aid photo orientation.

Response

The North arrow is located in the upper right hand corner of Figure 1.7 of the Internal Draft Work Plan.

#### Comment 4

Figure 1.7. The outline of the AOC 17 is not clear. It is requested that the actual outline be smaller and more specific in area.

✓ Response

Because no historic information concerning AOC 17 is available, a conservative approach was taken to outline the entire disturbed area identified using a stereoscope in a 1942 aerial photograph. Because of limitations in the quality of the color copy, the disturbed area is more apparent in the original aerial photograph than in Figure 1.7. The legend has been edited and the area labeled "Approximate Boundary of AOC 17". The AOC boundary and proposed sampling locations may be adjusted based on the results of the geophysical survey.

#### Comment 5

Figure 1.8. The outline area of AOC 17 will require changes to fit the recommendation in comment 4.

#### Response

See response to Comment 4.

#### Comment 6

Page 1-10, Section 1.6. The project objectives include confirmation of contamination based upon the TNRCC RRS program. In Section 4.1, referred to in Section 1.6, reference is made to TNRCC's Risk Reduction Program (30 TAC 335, Subchapter S, I996b). It is recommended that the contractor be aware that the most recent TNRCC RRP rules and guidelines (Sept 1999 30 TAC Chapter 350) might be required as a regulatory guidance.

#### *∨***Response**

Comment noted.

#### Comment 7

Page 2-1, Section 2.1.2. Figure 2.2 illustrates the Paluxy Formation to be a sandstone. In Section 2.1.3, Groundwater, discussion refers to the Paluxy as a sandstone. Section 2.1.3.3, Paluxy Aquifer, describes the Aquifer as consisting of an upper and lower sandstone unit. Boring, USGS07P on Cross Section B, Figure 2.6 uses the lithologic symbol for shale for the Paluxy. It is recommended that consistent lithologic symbols be used for the same Formation in a local area.

#### √**R**esponse

Lithologic symbols in the cross-sections refer to sediment/rock types rather than formations. A level of detail would be lost without the breakdown. There is no lithologic unit denoted as shale in the boring.

Comment 8

Table 2.1. The data points listed in Table 2.1 cannot be compared to the physical location of the same data points in Figure 2.10. It is recommended that data points in Figure 2.10 be labeled with a well numbers from Table 2.1, or a grid system for approximate location of the data points be included.

Response

Labeling groundwater figures with well names would require large plates for Figures 2.9 and 2.10. Because the purpose of Section 2.0 is to summarize basewide groundwater information, trends in water level elevations across the base are shown without specific monitoring well numbers. References for more specific basewide groundwater information is included in Section 2.1.3.1.

#### Field Sampling Plan

Comment 9

Page 3-2, Section 3.3.1. A metal detection survey will be conducted at the documented location of SWMU 21 according to the survey grid depicted on Figure 3.1. Figure 3.1 does not illustrate a survey grid for metal detection locations. It is recommended that the grid illustrate the sampling locations in order to provide guidance for field personnel.

Response

Figure 3.1 has been modified to show the locations of all proposed investigative activities as requested.

Comment 10

Page 3-3, Section 3.3.1. Field Sampling Plan Section: The location of the proposed 17 soil borings for SWMU's 19, 20, 21 are not illustrated in Figure 3.1. The locations of proposed soil boreholes should be illustrated in a figure if stated as such in the text. It is recommended that the locations be illustrated in Figure 3.1, and the locations marked by a symbol in the legend.

Response

See response to Comment 9.

Comment 11

Page 3-3, Section 3.3.1. Field Sampling Plan Section: Paragraph 4 states that two soil borings will be converted into groundwater monitoring wells, and the locations are depicted in Figure 3.1. The locations are not found in Figure 3.1, and the symbol for proposed monitoring wells in not listed in the legend. Please correct.

Response

See response to Comment 9.

#### Work Plan

Comment 12

Page 3-8, Section 3.5.1.1.5. It is recommended that the Intertek Testing Service (ITS) analytical data not be utilized for any purpose such as screening data.

Response

ITS data is presented for informational purposes only and will not be used for site characterization.

Comment 13

Page 3-10, Section 3.5.1.1.7. It is requested that further investigation of the Base records be performed for the history of the underground storage tank listed as SWMU 21.

Response

An extensive records search has been performed which included review of base site assessments, remedial action reports, TNRCC UST inventories, site walks, and interviews with base personnel. The search did not reveal any additional information pertaining to the SWMU 21 UST.

Comment 14

Page 3-10, Section 3.5.1.2. In paragraph 4, it is recommended that the number of borings referred to as a total of 17 be revised to a total of 19.

Response

An additional soil boring was added to the Former Fire Training Area as per Don Ficklen's Comment 5, revising the number of soil borings from 17 to a total of 18 borings. Soil boring locations are depicted on Figure 3.2.

Comment 15

Figure 3.2. It is recommended that the soil boring, in the northeast corner, being converted to a groundwater monitoring well be moved towards the perimeter of SWMU 19. In addition, three other soil borings in the east, southwest, and northwest corner should be placed towards the perimeter of SWMU 19.

Response

The sampling locations have been adjusted as requested.

Comment 16

Figure 3.4. It is recommended that the contractor remove the 3 soil boring locations located in the gray area to the south of SWMU 51 and 52.

Response

The 3 soil borings were proposed in order to characterize potential historic contamination of a small drainage ditch which runs directly to SWMU 53. As requested, these borings have been removed from the investigation.

Comment 17

Figure 3.5. The outline of AOC 17 should be appropriate and not be illustrated as a broad, general area. See comment no. 4.

Response

See response to Comment 4.

Comment 18

Page 3-16, Section 3.5.2.2. It is recommended that the reference to the number of borings shall be amended to reflect the removal of the three borings in Figure 3.4, as recommended by comment no. 16.

Response

The total number of soil borings proposed at SWMU 53 has been adjusted from 20 to 17 as requested.

Comment 19

Page 3-17, Section 3.5.2.2. Paragraph 7: The analytical list for ground-water analysis will be determined based upon the soil sampling results for the associated SWMU.

Response

The text has been changed to note that groundwater samples will be analyzed based on the results of the initial soil investigation.

Comment 20

Page 3-18, Section 3.5.3.2. It should be noted that if the two geophysical methods do not detect the presence of a landfill, then no soil borings would be necessary.

Response

When this suggested change was presented at the TNRCC/AFCEE meeting (March 21, 2000), the TNRCC rejected the change and insisted on the soil borings/sampling.

Comment 21

Page 3-19, Section 3.5.2.2. In paragraph 3, it should be noted that the suite of ground-water analytes will be determined based upon the results of the associated soil borings. This will not necessarily result in the full suite/list of Appendix IX constituents.

Response

The text has been changed to note that groundwater will be analyzed based on the results of the initial soil investigation.

Comment 22

Table 3.11. Row 3 and 5 in column 2 requires correction. Please revise.

Response

Table 3.11 has been changed to reflect the revised investigative activities.

HydroGeoLogic, Inc.—Responses to Comments, Internal Draft Work Plans, NAS Fort Worth JRB

Comment 23

Page 5-9, Section 5.7.1. General Requirements for Geophysical Surveys: It is stated that the locations of surface geophysical grid system layouts shall be shown on a site map. It is recommended that the grid system layouts and site map be included in the draft work plan for review and evaluation.

Response

See response to Comment 9.

Comment 24

Page 5-9, Section 5.7.2.1. Geonics EM61: It is stated that a systematic grid will be established at each site as shown on Figure 3.1. No grid system is found on Figure 3.1. It is recommended that the work plan/field sampling plan incorporate the grid layout on a plan view map for review and evaluation.

Response

See response to Comment 9.

Comment 25

Page 5-10, Page 5.7.2.2. Geonics EM31: The first paragraph discusses how a conductivity meter works. Paragraph two states that a grid layout as shown in Figure 3.3 will be used. Figure 3.3 does not depict the grid layout specifically for an electrical conductivity survey. For a work plan and field sampling guide, it is recommended that text describing how geophysical equipment functions be deleted, and the space devoted to the field grid layout for the survey. It is recommended that the grid layout on plan view be included for review and evaluation.

Response

The geophysical survey grid depicted on Figure 3.3 consists of  $20 \times 40$  foot cells as described in section 5.7.2.2. The name of the grid in Figure 3.3 has been changed from "Sampling Grid" to "Geophysical Survey Grid", for clarification. The geophysical methods are described in the Work Plans in order to present the differences between the two electromagnetic methods being used, and to inform the field personnel about general geophysical surveying concepts.

Field Sampling Plan

Comment 26

Page 6-2, Section 6.1.1.1. Water Level Measurements: It is recommended that the method for computing and reporting the water level be discussed. For example, will the depth to water level be subtracted from ground surface elevation to determine the mean sea level elevation of the water surface?

Response

Specific water level measurement procedures were added to Section 6.1.1.1 as requested.

#### Work Plan

#### Comment 27

Page 1-7, Section 1.3.3. There has been new construction since the base map utilized by HGL was developed. Bldg. 1825, 1826, 1828, and 1830 have been demolished and replaced by a new Building 1803. Therefore the first sentence should end with "Building 1803."

#### Response

The text and associated figures have been changed as requested.

#### Comment 28

Figure 1.4. Visual Inspection of the site indicates that the direction of Photograph A was taken in a Southeastern direction from the left of Photograph B.

#### Response

Figure 1.4 has been changed as requested.

#### Comment 29

Figure 1.6. The building 1230 shown on the left photo is not indicated on any of these figures for SWMU 53. Monitoring Well ST14-W10 is not labeled.

#### Response

Figure 1.6 has been revised to include Building 1230 and monitoring well ST14-W10 was labeled as requested.

#### Comment 30

Figure 1.8. The building numbers are incorrect/outdated. Revise the numbering system in accordance with the building numbers correctly indicated on Figure 3.5.

#### Response

Figure 1.8 has been revised with updated building numbers as requested.

#### **Health and Safety Plan**

#### Comment 31

Table 13.1. Under Ambulance and Fire Department, delete the phone numbers for the White Settlement Fire Department. Insert Instructions that "while on base, when using a mobile Phone, call the base Fire Department at 817-782-6330 for Ambulance or fire response. From a permanent base phone, dial 911."

#### Response

The instructions were added as suggested. In addition, it was noted that in situations where the (817)782-6330 number is busy or unavailable, 911 should be dialed and the operator will transfer the caller to the Naval Air Station's emergency phone line.

#### Responses to Don Ficklen's, AFCEE/ERD, Comments

#### Comment 1

Figure 1.5. What was the Corps' rationale for stopping the removal action and installing a liner although contamination was left in place?

#### Response

According to the Final Summary Report - Remediation Project SWMUs 19, 20, and 53, Dames & Moore submitted a proposal to collect additional soil samples at SWMUs 19 and 20 after receiving laboratory results indicating that soil contamination was above cleanup goals. The USACE rejected this proposal on June 28, 1993. According to Dames & Moore, the USACE stated that they had the option to complete the remediation program without obtaining the cleanup goals due to ongoing work at the base. In July 27, 1993 USACE sent a letter to Dames & Moore releasing them from the requirement to achieve cleanup goals at SWMUs 19 and 20 and to proceed with the installation of the clay liner. No USACE documentation pertaining to the remediation project was found.

#### Comment 2

Figure 1.7. Why does the outline of the AOC include more area than the trenches? Were additional photos used to make the outline? Should the outline extend further north east to include more of the shaded area?

#### Response

See response to UNITEC's Comment 4.

#### Comment 3

Page 3-17, fifth paragraph. The second sentence should be changed to the following (or something similar): "Groundwater samples will be analyzed for all constituents detected in soil samples collected from SWMU 53 above background/RRS 1 levels."

#### Response

The fifth paragraph was changed to state that three rounds of bimonthly groundwater sampling will be conducted and groundwater samples will be analyzed for a reduced list of analyses based on the results of the initial soil investigation.

#### Comment 4

Page 3-18. Why are we using an EM31 for AOC 17 and an EM61 for SWMUs 19, 20, and 21?

#### Response

The EM61 was selected for use at SWMUs 19, 20, and 21 because it is an ideal instrument for identifying a UST, and because it provides high resolution; however, it will not detect non-metallic objects. The EM31 was proposed for use at AOC 17 because it measures the conductivity of the subsurface, which is preferred for identifying and delineating areas

of disturbed soils that are associated with landfills. The EM31 will also detect conductive bodies, such as buried metallic objects in a landfill.

#### Comment 5

Figure 3.2. Add a boring between SWMUs 19 and 21 (near NW corner of SWMU 21) in a similar location to the boring between SWMUs 19 and 20. Should we also add a boring above the "e" in berm?

#### Response

As per the response to UNITEC's Comment 15, the boring in the northwest corner was moved closer to SWMU 19, and is positioned in the location suggested above (between SWMUs 19 and 21). A boring was added to the south of SWMU 19 (above the "e" in berm), as suggested.

#### Comment 6

Figure 3.4. Why are we sampling the (small) ditch?

#### Response

The borings in the small ditch have been removed per Comment 16. The borings were intended to characterize any contamination flowing from the small ditch to SWMU 53.

#### Responses to Ray Risner's, TNRCC, Comments from March 21 Meeting

Comment 1

SWMUs 19, 20, and 21. Delineate any UST (SWMU 21) related contamination found during the Phase I (soil) Investigation.

Response

Comment noted.

Comment 2

SWMUs 19, 20, and 21. In regards to solvents (i.e., TCE) both upgradient and downgradient analytical data should be included in the RFI report in order to determine if SWMUs 19, 20, and 21 contribute to the basewide TCE plume.

Response

Comment noted.

Comment 3

SWMU 53. Look for any available analytical data in the sanitary sewer system RFI that would provide additional information on the amount of contamination that resulted from the ruptured pipe. However, if the break in the pipe occurred between the fuel systems shop and the Building 1190 OWS, the investigation should be covered and reported as part of the sanitary sewer system RFI.

Response

Any additional information found pertaining to the ruptured pipe will be included in the RFI.

Comment 4

SWMU 53. Include text in the report that indicates that the structure/integrity of the concrete liner running the length of SWMU 53 will be inspected for cracks/gaps during Phase I of the RFI. Also include a more details in regards to where SWMU 53 ends/discharges (i.e. North Gate OWS?), and confirm that the receiving structure is covered as an investigative unit on the Base.

Response

Text was included as suggested. More details regarding SWMU 53 and it's discharge point will be incorporated into the RFI.

Comment 5

SWMU 53. If the integrity of the concrete within SWMU 53 is not intact (i.e. displaying cracks/gaps/deteriorated seams) soil borings should be advanced through these areas and soil samples collected beneath the liner. Include information on any repairs/patches to damaged concrete as part of the RFI.

Response

The sampling procedures requested were included in the text. Any work conducted on the concrete liner will be included in the RFI as suggested.

Comment 6

SWMU 53. Add two additional soil borings at SWMU 53. The first additional boring should be advanced at the north end of the drainage ditch, slightly southeast of the first "elbow". The second additional boring should be advanced at the south end of the drainage ditch, slightly southeast of the last "elbow".

Response

The borings will be added as suggested.

Comment 7

AOC 17. The soil investigation should be conducted even if the results of the geophysical survey are inconclusive. VOCs and SVOCs may exist in the landfill even if no debris/anomalies are detected.

Response

The text will be changed to state that a soil investigation will be conducted at the site as originally planned (prior to UNITEC Comment 20).

Comment 8

Some of the proposed borings should be moved into the center of the AOC. Three borings should be advanced in the middle of the AOC, based on any anomalies detected during the geophysical survey, as well as based on the locations of trenches in the aerial photos. Four additional borings should be advanced near the perimeter of the AOC, for a total of 7 Phase I soil borings. Any additional delineation and a groundwater investigation (if necessary) should take place during Phase II.

Response

Soil borings will be added/moved as suggested.

Comment 9

AOC 18. The number of Phase I borings should be reduced from 5 to 4. The location of the borings in the center of the site should not change. The two southern borings should be moved inside the AOC off the parking lot, into the grass; and one boring location in the center of the north end of the AOC will be sufficient to characterize the northern area during Phase I.

Response

One boring was eliminated and other borings were moved as suggested.

Comment 10

AOC 18. A full Appendix IX suite of analyses will not be necessary, and a reduced list of Appendix IX VOCs, SVOCs, and metals/mercury can be used.

Response

A reduced list of analyses will be used.

Comment 11

AOG 19. The locations of the three borings around the perimeter of AOC 18 should be moved further inside the unit.

Response

The borings were moved as suggested.

Comment 12

AOC 19. All data collected during the investigation of SWMU 25 should be included in the RFI report for AOC 19.

Response

SWMU 25 data will be incorporated into the RFI report as suggested.

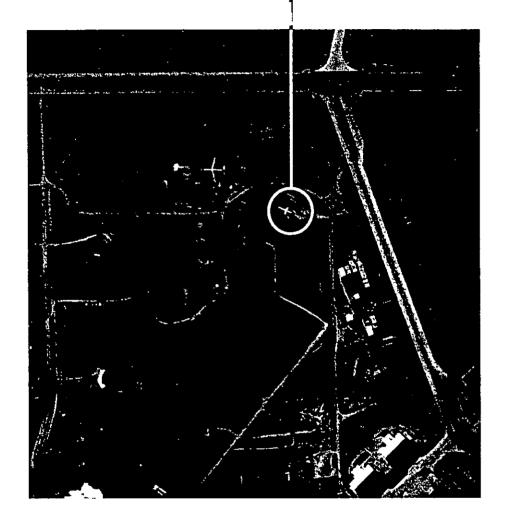
Comment 13

AOC 19 A full Appendix IX suite of analyses will not be necessary, and a reduced list of Appendix IX VOCs, SVOCs, and metals/mercury can be used.

Response

A reduced list of analyses will be used.

## Location of Suspected Fire Training Area 3



Drawn/Scanned by:
C. Farmer

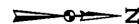
Checked by:
M. Rodtang

Date: 01/08/98

Filename: AFCEE\NAS\_FW\_JRB\FTA\
, FTA\_fig5.cdr



Figure 5 Aerial Photograph December 3, 1958



Approximate Scale 1:8,600

# Fire Training Area B



Drawn/Scanned by:
C. Farmer

Checked by:
M. Rodtang

Date: 12/31/97

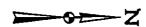
Date: 01/08/98

Filename: AFCEE\NAS\_FW\_JRB\FTA\

FTA\_fig6.cdr



Figure 6 Aerial Photograph February 3, 1954



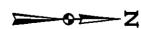
Approximate Scale 1:12,000

## \_Former Loca`ion of Suspected Fire Training Area B





Figure 7
Aerial Photograph
August 22, 1962



Approximate Scale 1:12,300

#### \_Location of Suspected Law Ifill



Drawn/Scanned by: C. Farmer	Date: 12/31/97
Checked by: Rodtang	Date: 01/08/98
Filename: AFCEE\NA	S FW JR3\FTA\

FTA\_fig8.cdr

HYDRO Geologia Figure 8 Aerial Photograph April 10, 1942



Approximate Scale 1:10,000

...F ramer 'Lo ation of Suspe led Landfill

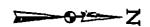


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Checked by: M. Rodtang	Date: 01/08/98	

Filename: AFCEE\NAS\_FW\_JRB\FTA\
FTA\_fig9.cdr



Figure 9 Aerial Photograph April 4, 1944



Approximate Scale 1:10,000

### TEXAS WATER COMMISSION

B. J. Wynne, III, Chairman John E. Birdwell, Commissioner Cliff Johnson, Commissioner



John J. Vay, General Counsel
Michael E. Field, Chief Hearings Examiner
Brenda W. Foster, Chief Clerk

February 13, 1991

Allen Beinke, Executive Director

Dear Permittee: RE: U.S. DEPT OF AIR FORCE - CARSWELL AFB; Permit HW50289

Enclosed is a copy of:

- ( ) 1. Permit for a wastewater treatment facility issued pursuant to Chapter 26 of the Texas Water Code. In order that you may comply with monitoring requirements of your permit, self-reporting forms and instructions will be forwarded to you from the Water Quality Division at an early date. If your facility is not yet operating, please use the attached Notification of Completion of Facilities form to advise this agency and our district office of the completion or placement in operation of proposed facilities in accordance with the special provision incorporated into the permit.
- ( ) 2. Amended permit for a wastewater treatment facility issued pursuant to Chapter 26 of the Texas Water Code. Please continue using the self-reporting forms you have on hand until new forms are forwarded by the Water Quality Division. If your facility is not yet operating, please use the attached Notification of Completion of Facilities form to advise this agency and our district office of the completion or placement in operation of proposed facilities in accordance with the special provision incorporated into the permit.
- ( ) 3. Renewal of a permit for a wastewater treatment facility issued pursuant to Chapter 26 of the Texas Water Code. If your facility is not yet operating, please use the attached Notification of Completion of Facilities form to advise this agency and our district office of the completion or placement in operation of proposed facilities in accordance with the special provision incorporated into the permit.
- 4. Permit for a hazardous or solid waste facility issued pursuant to Art. 4477-7, Texas Revised Civil Statutes. Your attention is directed to Commission Rule 335.5 which may be applicable to your facility.
- ( ) 5. Permit or amended permit for a waste disposal well or an injection well issued pursuant to Chapter 27 of the Texas Water Code. In accordance with the Texas Water Code, you must file a copy of the permit with the city and county health authorities.

If there are any questions concerning this permit, please let us know.

Gloria A. Vasquez, Chief Clerk

cc w/enclosures:

All Parties

TWC District Office 4

IS FEB LON



# TEXAS WATER COMMISSION Stephen F. Austin State Office Building Austin, Texas

PERMIT FOR MUNICIPAL
HAZARDOUS WASTE MANAGEMENT SITE
issued under provisions of TEX.
HEALTH & SAFETY CODE ANN.
Chapter 361 (Vernon)

Name of Permittee:

U.S. Air Force/Carswell Air Force Base

7CSG/CC Carswell AFB

Fort Worth, Texas 76127-5000

Site Owner:

United States Department of the Air Force

CI.

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7CSG/CC Carswell AFB

Fort Worth, Texas 76127-5000

Classification of Site:

Class I Hazardous Waste Storage,

Off-site, Non-commercial

The permittee is authorized to store and process wastes in accordance with the limitations, requirements, and other conditions set forth herein. This permit is granted subject to Texas Water Commission (TWC) rules, other Orders of the TWC. and laws of the State of Texas. Nothing in this permit exempts the permittee from compliance with the applicable rules and regulations of the Texas Air Control Board (TACB).

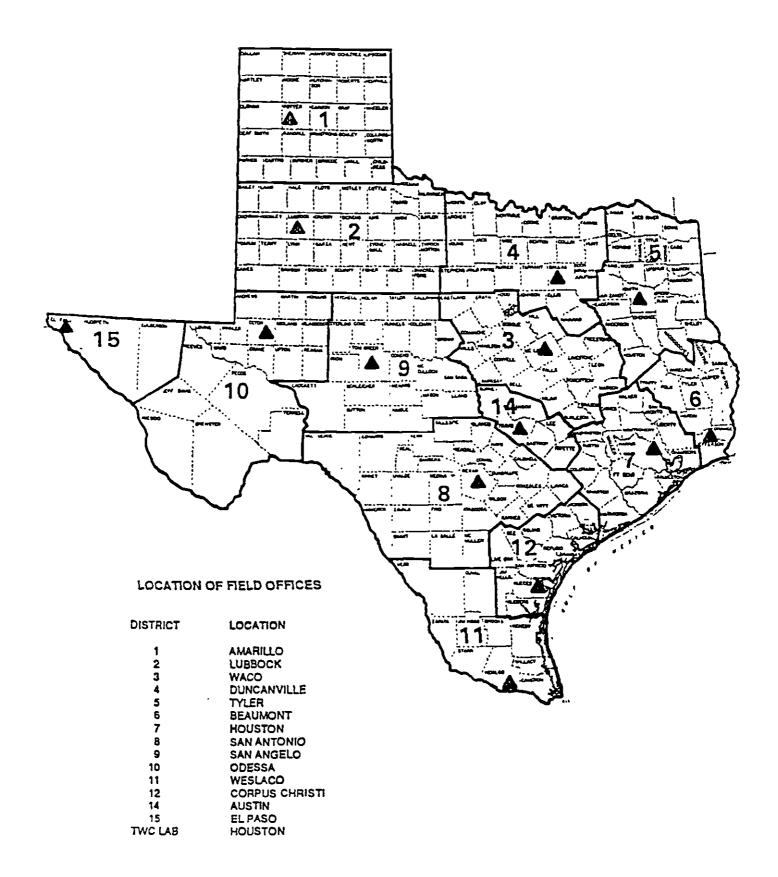
This permit will be valid until cancelled, amended, or revoked by the Commission, except that the authorization to store and process wastes shall expire midnight, 10 years after the date of permit approval.

All provisions in this permit stem from both State and Federal authority. The provisions marked with as asterisk (\*)-stem from Federal authority and will implement the applicable requirements of HSWA not presently authorized to the State of Texas.

APPROVED, ISSUED, AND EFFECTIVE this 7th day of February, 1991

ATTEST: Blowin a. Warguey

For the Commission



#### TEXAS WATER COMMISSION FIELD OPERATIONS DIVISION AREA OFFICES

#### DISTRICT 1

3918 Canyon Drive Amarillo, Texas 79109-4996 806/353-9251 (TEX-AN 8-862-0071) Don Manning, District Manager

#### DISTRICT 2

3411 Knoxville, Suite 101 Lubbock, Texas 79413-2249 806/796-7092 (TEX-AN 8-840-1067) Larry L. Smith, District Manager

#### DISTRICT 3

14000 Woodway Drive Waco, Texas 76712-3193 817/751-0335 (TEX-AN 8-820-1465) William F. Bowles, District Manager

#### >DISTRICT 4 .--

1019 N. Duncanville Rd. Duncanville, Texas 75116-2201 214/298-6171 (TEX-AN 8-831-5650) Charles D. Gill, District Manager

#### DISTRICT 5

2916 Teague Drive Tyler, Texas 75701-3734 214/595-5466 (TEX-AN 8-831-5256) John Witherspoon, District Manager

#### DISTRICT 6

4820 Ward Drive Beaumont, Texas 77705-0328 409/842-9413 (TEX-AN 8-850-1383) Keith Anderson, District Manager

#### DISTRICT 7

5144 East Sam Houston Parkway North Houston, Texas 77015 713/457-5191 (TEX-AN 8-730-0200 or 0300) Gerald Hord, District Manager

#### TWC LABORATORY

5144 East Sam Houston Parkway North Houston, Texas 77015 713/457-5229 (TEX-AN 8-730-0200 or 0300) Jim Busceme, Lab Manager

#### →DISTRICT 8

140 Heimer, Road, Suite 360 San Antonio, Texas 78232-5028 512/490-3096 (TEX-AN 8-820-1308 and 820-1314) Billy Boggs, District Manager

#### DISTRICT 9

102 Canyon Road San Angelo, Texas 76904 915/655-9479 or 655-1336 Kenneth W. Krueger, District Manager

#### DISTRICT 10

2626 J.B. Shepperd Parkway Blvd. Bldg. B-129 Odessa, Texas 79761 915/362-6997 (TEX-AN 8-840-1432) William F. Lockey, District Manager

#### DISTRICT 11

813 E. Pike Blvd. Weslaco, Texas 78596-4935 512/968-3165 (TEX-AN 8-820-1826) John Sturgis, District Manager

#### DISTRICT 12

4410 Dillon Lane, Suite 47 Corpus Christi, Texas 78415-5326 512/851-8484 (TEX-AN 8-820-1682) Chip Volz, District Manager

#### DISTRICT 14

1700 South Lamar, Bldg. 1, No. 101 Austin, Texas 78704-3360 512/463-7803 (TEX-AN 8-255-7803) W. John Young, District Manager

#### DISTRICT 15

7500 Viscount Blvd., Suite 147 El Paso, Texas 79925 915/778-9634 (TEX-AN 8-846-8183) Hector Villa, District Manager PERMIT NO. HW-50289

CONTINUATION SHEET 2 OF 20

EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

#### I. Size and Location of Facility

- A. Carswell Air Force Base occupies 2751 acres of land in urban Tarrant County, Texas. The Base is positioned along the south shore of Lake Worth and is bordered by the following entities: Fort Worth and Westworth on the east; Fort Worth and White Settlement on the south; White Settlement on the southwest; and Fort Worth and Air Force Plant 4 on the northwest. the location is further described as being in Segment 0806 of the Trinity River Basin (North Latitude 32°45'53", West Longitude 97°25'44").
- B. The site plan and accompanying field notes describing the waste management sites which were submitted in the application for Permit No. HW-50289 are hereby made part of this permit as "Attachments A and B", respectively.

#### II. Units and Operations Authorized

#### A. Wastes Authorized:

- The permittee is authorized to manage hazardous industrial solid waste listed in the application and described herein, subject to the limitations provided herein. Authorized wastes may be received from off-site federal facilities.
- 2. Hazardous wastes authorized to be managed under this permit are limited as follows:
  - a. Hazard Code Groups (as prescribed by the U.S. Environmental Protection Agency regulations in effect upon the date of permit approval):

x Ignitable Waste (I)	<u>X</u> Acute Hazardous Waste (H)
<u>x</u> Toxic Waste (T)	x Toxicity Characteristic (TC)
x Corrosive Waste (C)	x Reactive Waste (R)

ъ.	Waste Descriptions	TWC <u>Waste Class</u>	Hazard <u>Code</u>
	(1) Acetic Acid	IH	C
	(2) Acetone	IH	I
	(3) Alcohol, Denatured	IH	I
	(4) Amyl Alcohol	IH	I
	(5) Aniline	IH	T
	(6) Aqueous Liquids w/pH < 2	IH	С
	(7) Aqueous Liquids w/pH > 12.	5 IH	С
	(8) Arsenic Acid	IH	C.H
	(9) Battery Electrolyte	IH	c c

CONTINUATION SHEET 3 OF 20

PERMIT NO. HW-50289 EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

[II.A.2.b.]

		TWC	Hazard
ъ.	Waste Descriptions	Waste Class	Code Code
Β,	WASCE DESCRIPCIONS	Hance Olass	COGE
	(10) Batteries, dry cell	IH	TC,C,R
	(11) Batteries, Metal/electrol		TC,C,R
	(12) Benzene	IH	
		IH	T
	(13) Benzene, Hydroxy/Phenol	IH	T
	(14) Boric Acid		Ç
	(15) Buthyl Alcohol	IH	<u>I</u>
	(16) Cadmium-bearing waste	IH	Ţ
	(17) Carbon Disulphide	IH	Ţ
	(18) Carbon Tetrachloride	IH	Ţ
	(19) Chlorine	IH	R,T
	(20) Chloroform	IH	T
	(21) Chromium-bearing waste	IH	T
	(22) Corrosion Inhibitor	IH	T
	(23) Corrosive Liquid	· IH	С
	(24) Cyclohexanone	IH	I
	(25) DDT	IH	T
	(26) Dichloride Ethylene	IH	I
	(27) Dichlorodifluromethane	IH	Ī
	(28) Dichlorofluromethane	IH	Ī
	(29) DS-2 Decontamination Ager		R,C
	(30) Ethoxyethanol	IH	I
		IH	Ť
	(31) Ethyl Acetate	IH	Ī
	(32) Ethyl Alcohol	IH	
	(33) Ethyl Benzene		I,T
	(34) Ethyl Ether	IH	Ţ
	(35) Formaldehyde	IH	Ţ
	(36) Formic Acid	IH	Ţ
	(37) Halogenated Solvent	IH	I
	(38) Heptane	IH	I
	(39) Hexachlorobenzene	IH	T
	(40) Hexahydrobenzene	IH	T
	(41) Hexane	IH	I
	(42) Hexanol	. IH	I
	(43) Hydrazine or Diamine	IH	T,R
	(44) Hydrochloric Acid	IH	c `
	(45) Ignitable Liquid and		
	Solid Waste	IH	I
	(46) Isopentyl Alcohol	IH	Ī
	(47) Isopropyl Alcohol	IH	Ī
	(48) Iso-Butanol	IH	Ī
	(49) Lead-Bearing Waste	IH	Ť
	· · · · ·	IH	Ř
	(50) Lithium Batteries		
	(51) Mercury-contaminated was		T,TC
	(52) Mercury Batteries	IH	TC
	(53) Methanol	IH	T,I
	(54) Methyl Ethyl Ketone	IH	T,I
	(55) Methyl Isobutyl Ketone	IH	T,I
	(56) Methylene Chloride	IH	Ţ,I
	(57) Naptha Petroleum	IH	Į ,
	/50\ \Tamebalama	TU	т

CONTINUATION SHEET 4 OF 20

PERMIT NO. HW-50289

EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

#### [II.A.2.b.]

	TWC	Hazard
<u>Waste Descriptions</u>	Waste Class	<u>Code</u>
(59) Nickel-Cadmium Batteries	IH	TC
(60) Nitric Acid	IH	С
(61) 2-Nitropropane	IH	I,T
(62) Non-halogenated Solvents	IH	T
(63) Oil, Metal-Contaminated	IH	TC
(64) Oxalic Acid Powder	IH	C
(65) Paint Filters	IH	I,T
(66) Paint-related Material	IH	I
(67) Paint Thinner	IH	I,T
(68) PD-680	IH	I,T
(69) Pentane	IH	I
(70) Pesticides	IH	C,T
(71) Petroleum-derived Fuel-Was	ste IH	I,TC
(72) Phosphoric Acid	IH	C
(72) Phosphoric Acid (73) Photographic Chemicals	IH	T
(74) Potassium Cyanide	IH	R,H
(75) Pyridine	IH	T
(76) Reactive Waste	IH	R
(77) Rifle Bore Cleaner	IH	I
(78) Silver Nitrate	IH	TC
(79) Sodium Hyroxide	IH	С
(80) Sodium Nitrite	IH	R
(81) Stoddard Solvent	IH	I
(82) Sulfuric Acid	IH	С
(83) Tetrachloroethane	IH	T,C
(84) Tetrachloroethylene	IH	T
(85) Tetrachloromethane	IH	T
(86) Toluene	IH	T,I
(87) Trichloroethane-1,1,1	IH	T
(88) Trichloroethylene	IH	T
(89) Trichlorofluoromethane	IH	T
(90) Trichloromethane	IH	T
(91) Trichlorotrifluoroethane	IH	T
(92) Turpentine (93) Vinyl Chloride	IH	I
(93) Vinyl Chloride	IH	I
(94) Xylene	IH	I

#### B. Unit Authorized:

The permittee is authorized to operate the following unit for storage subject to the limitations contained herein. All waste management activities subject to permitting are to be confined to the following unit:

Container Storage Area, enclosed, capacity 29,700 gallons (NOR 02), identified as conforming storage unit in the application, for storage of the wastes described in <u>Provision II.A.2.b.(1)-(94)</u>.

CONTINUATION SHEET 5 OF 20

PERMIT NO. HW-50289 EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

#### [II.]

- C. The unit and operational methods authorized are limited to those described both herein and by the application and related plans and specifications which were included in the permit application submittals dated September 6, 1989, May 2, 1990, and August 21, 1990. Prior to constructing or operating any unit in a manner which differs from either the related plans and specifications or the limitations of this permit, the permittee is required to
  - 1. Notify the TWC and submit plans and specifications for the proposed modification; and
  - Receive written authorization of the Executive Director for such modification, if the Executive Director determines that a permit amendment or modification is not required by TWC rules.
- D. Authorization to begin operation of new units is contingent upon compliance with <u>Provision II.E. and V.C.</u>
- E. Any proposed unit modifications, addition of units, or expansion in capacity which has not been addressed by the terms of this permit must be authorized in accordance with TWC permit amendment or modification rules.

#### III. Unit Design, Construction, and Operation

- A. General Design, Construction, and Certification Requirements:
  - 1. Unit design, construction, and operation must comply with this permit, TWC Rules, and be in accordance with the plans and specifications for design, construction and operation approved herein. All plans submitted with the application dated September 6, 1989, May 2, 1990, and August 21, 1990 are approved, subject to the terms of this permit and any other orders of the TWC which are hereby incorporated by reference and made a part of this permit.
  - The facility shall be designed, constructed, operated, and maintained to prevent washout of any hazardous waste. At a minimum, all storm-water control structures shall be designed and constructed to prevent washout of any hazardous waste by a 100-year flood.
  - 3. The authorized unit shall be clearly identified as numbered in <u>Provision II.B.</u> At a minimum, unit identification signs must be conspicuously posted on the approaches to the permitted units indicating "TWC PERMIT UNIT NO. (from <u>Provision II.B.</u>)," (for example, the conforming storage unit shall be labelled "TWC PERMIT UNIT NO. 1").

CONTINUATION SHEET 6 OF 20

PERMIT NO. HW-50289 EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

[III.]

- B. General Operational Requirements:
  - 1. The permittee shall comply with the requirements of Title 40, Code of Federal Regulations (40 CFR) §264.17.
  - 2. The permittee shall within 24 hours remove any spilled hazardous waste and waste residues and shall take steps necessary to prevent surface-water contamination as a result of spills.
  - 3. The permittee shall manage all wastes within the facility unit in a manner in which particulate emissions of waste to the air meet TACB and TWC requirements.
  - 4. All contaminated water as identified by <u>Provisions III.B.5</u>, <u>IV.B 2. and IV.B.3.</u> shall be disposed of by the following method(s):
    - Removal to an on-site, authorized industrial solid waste unit;
    - Removal off-site to an authorized industrial solid waste management facility; and/or
    - Removal to an authorized wastewater treatment system.
  - 5. The permittee shall ensure that any equipment which has come in contact with hazardous waste has been decontaminated prior to exiting the unit. At a minimum, all contaminated equipment shall be washed sufficiently to remove waste residues. All wash water generated shall be collected and disposed of in accordance with Provision III.B.4.
  - The annual site activity report required by <u>Provision V.F.</u>
    shall be submitted to the TWC Central Office and the TWC
    District 4 Office by January 25 of each year for the preceding year's activities. This annual report shall include, at a minimum, the following information:
    - a. All information and records required by 31 Texas Administrative Code (TAC) §335.154; and
    - b. Volume of all wastes stored at the facility unit authorized in <u>Provision II.B.</u>; and
    - c. A description of waste processing capabilities and capacities corresponding to each type of waste managed on-site.

PERMIT NO. HW-50289 CONTINUATION SHEET 7 OF 20

EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

#### [III.B.]

- 7. The permittee shall ensure that all waste analyses utilized for waste identification or verification have been performed in accordance with methods specified in the current editions of "Test Methods for Chemical Analysis of Water and Wastes" or "Test Methods for the Evaluation of Solid Waste" (SW-846) or other methods which are officially approved by the United States Environmental Protection Agency (U.S.E.P.A.). The permittee shall utilize only laboratories which follow a quality control/quality assurance program conforming to the program specified in "Test Methods for the Evaluation of Solid Waste" (SW-846).
- 8. The permittee shall comply with inspection requirements of 40 CFR §264.15.
- 9. The permittee shall comply with the training requirements of 40 CFR §264.16.
- 10. All tanks, sumps, pumps, fire and spill control equipment, decontamination equipment, and all other equipment and structures authorized or required by this permit shall be maintained in good functional condition.
- 11. The permittee shall comply with the security requirements of 40 CFR §264.14.
- C. Container Storage Area Design, Construction, and Operation Requirements:

The permittee shall comply with the following minimum requirements for the container storage areas authorized by <u>Provision II.B.</u>

- 1. The container storage areas shall be constructed and operated to comply with 40 CFR §§264.170-264.178.
- 2. In addition, within 30 days of permit issuance by the TWC, the permittee shall comply with the following minimum requirements for the container storage area authorized by <u>Provision II.B.</u>:
  - a. The permittee shall provide a minimum of 30" aisle spacing between double rows of drums;
  - b. Drums of 55 gallons or more capacity shall not be stacked more than three high;
  - c. Pallets shall be used between layers of stacked drums; and
  - d. Drums of incompatible wastes shall be separated by an impermeable barrier.

CONTINUATION SHEET 8 OF 20

PERMIT NO. HW-50289 EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

#### [III.]

- D. The entire waste management facility shall be designed, constructed, operated, and maintained to prevent inundation of and discharges from the areas surrounding the facility components authorized by Provision II.B., subject to the following requirements:
  - 1. Each receipt, storage, and processing area, including unloading areas, shall be provided with a drainage control system which will collect spills and incident precipitation in such a manner as to
    - a. Preclude the release from the system of any collected spills, leaks, or precipitation, except as provided in <u>Provision III.D.2</u>. This requirement shall be met by, at a minimum, providing a base and sides which are free of cracks or gaps and are sufficiently impervious to contain leaks, spills, or precipitation until the collected material is removed, and providing curbs or sides designed to withstand a full hydrostatic head;
    - b. Minimize the amount of rainfall that is collected by the system;
    - c. Prevent run-on into the system from non-storage and processing areas; and
    - d. Have sufficient capacity to contain the volume of the largest tank or 10% of the total tank and/or container capacity, whichever is greater, plus (for unenclosed areas) the volume of rainwater which would be collected by the 25-year, 24-hour rainfall event (7.5 in.).
  - 2. Collected spills, leaks, clean-up residues, and contaminated rainfall runoff including stormwater from all waste management containment areas shall be removed promptly after the spillage and/or rainfall event in as timely a manner as is necessary to prevent overflow of the collection system, by the following method(s):
    - a. Removal to an on-site authorized industrial solid waste unit:
    - b. Removal off-site to an authorized industrial solid waste management facility; and/or
    - c. Removal to an authorized wastewater treatment system.

#### IV. Closure

- A. General Closure Requirements:
  - Facility closure shall commence whenever any of the following conditions exist:

CONTINUATION SHEET 9 OF 20

PERMIT NO. HW-50289 EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

#### [IV.A.1.]

- a. Upon direction of the TWC or the Executive Director for violation of the permit, TWC Rules, or State Statutes;
- b. Upon suspension, cancellation, or revocation of the terms and conditions of this permit concerning the authorization to store, process, or dispose of waste materials;
- c. Upon abandonment of the site;
- d. When necessary to comply with Provision VII.C.
- 2. The permittee shall submit a written request for a permit amendment or modification to authorize a change in operating plans, unit design, or the approved closure plan in accordance with the time frames of <u>Provisions IV.A.3.a.-d.</u> The written request shall include a copy of the amended closure plan for approval by the Executive Director. The permittee shall submit a written request for a permit amendment or modification to authorize a change in the approved closure plan whenever any of the following conditions exist:
  - a. Changes in operating plans or facility design affect the approved closure plan;
  - b. There is a change in the expected year of final closure, if applicable;
  - c. In conducting partial or final closure activities, unexpected events require amendment of the approved closure plan;
  - d. Requested by the Executive Director under the conditions described in <u>Provisions IV.A.2.a.-c.</u>
- 3. The permittee shall submit a written request for a permit amendment or modification according to the following schedule:
  - a. At least 60 days prior to the proposed change in unit design or operation which will affect the approved closure plan;
  - b. No later than 60 days after an unexpected event has occurred which has affected the closure plan;
  - c. No later than 30 days after an unexpected event has occurred, if the unexpected event occurs during the partial or final closure period; or
  - d. Within 60 days of the Executive Director's request pursuant to <u>Provision IV.A.4.d.</u>, or within 30 days if the change in facility conditions occurs during partial or final closure.

CONTINUATION SHEET 10 OF 20

PERMIT NO. HW-50289 EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

#### [IV.A.]

- 4. The permittee shall notify the Executive Director in writing at least 45 days prior to the date on which final closure of the facility is expected to begin. A copy of the notice shall be submitted to the TWC District 4 Office.
- 5. Within 60 days of the completion of final closure, the permittee shall submit to the Executive Director by registered mail, with a copy to the TWC District 4 Office, a certification that the hazardous waste management unit or facility, as applicable, has been closed in accordance with the specifications in the approved closure plan and the terms of this permit. The certification shall be signed by the permittee and by an independent registered professional engineer. Additional documentation supporting the independent registered professional engineer's certification shall be furnished to the Executive Director upon request.
- B. Hazardous Waste Management Unit Area Closure Requirements:
  - All tanks, pumps, piping, and any other equipment or structures which have come in contact with waste shall either be decontaminated by removing all waste or disposed of at an authorized facility.
  - 2. All wash water generated during decontamination activities shall be collected and disposed of in accordance with <u>Provision III.B.4.</u>
  - 3. All hard-surfaced areas within the hazardous waste management unit areas shall be decontaminated and the wash water generated shall be collected and disposed of in accordance with <u>Provision III.B.4.</u>
  - 4. Verification of decontamination shall be performed by analyzing wash water for the waste constituents which have been in contact with the particular item being decontaminated.

#### V <u>Standard Permit Conditions</u>.

The permittee has a duty to comply with the Standard Permit Conditions under 31 TAC §305.125. Moreover, the permittee has a duty to comply with the following permit conditions:

A. In order to continue a permitted activity after the expiration date of the permit the permittee shall submit a new permit application at least 180 days before the expiration date of the effective permit, unless permission for a later date has been granted by the Executive Director. Authorization to continue such activity will terminate upon the effective denial of said application.

CONTINUATION SHEET 11 OF 20

PERMIT NO. HW-50289 EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

[V.]

- B. The permittee need not comply with the conditions of this permit to the extent and for the duration such noncompliance is authorized in an emergency order issued by the TWC.
- C. For a new facility or unit requiring permitting, the permittee shall not commence storage, processing or disposal of solid waste; and for a permitted facility or unit being modified, the permittee shall not process, store or dispose of solid waste in the modified portion of the facility or unit, until the following requirements have been satisfied:
  - 1. The permittee has notified the local TWC District Office and submitted to the Executive Director by certified mail or hand delivery a letter signed by the permittee and a Texas registered professional engineer certifying that the facility or unit has been constructed or modified in compliance with the permit. Required certification shall be in the following form: This is to certify that the construction of the following facility unit(s) authorized or required by TWC Permit No. HW-50289 has been completed, and that construction of said facility unit(s) has been performed in accordance with and in compliance with the design and construction specifications of Permit No. HW-50289. (Description of facility units and components with reference to applicable permit provisions).
    - a. The permittee must also submit notification and documentation materials as described in <u>Permit Provision C.1.</u> to the Director of Hazardous Waste Division, U.S.E.P.A., Region VI Office.
  - 2. The Executive Director has inspected the modified or newly constructed facility or unit and finds it is in compliance with the conditions of the permit; or within 15 days of submitting the letter required by <u>Provision V.C.l.</u>, the permittee has not received notice from the Executive Director of an intent to inspect, prior inspection is waived and the permittee may commence processing, storage or disposal of solid waste.
- D. The following details shall be included as information which must be reported orally within 24 hours pursuant to 31 TAC §305.125(9):
  - 1. Information concerning release of any solid waste that may cause an endangerment to public drinking water supplies.
  - 2. Any information of a release or discharge of solid waste, or of a fire or explosion from a facility unit, which could threaten the environment or human health outside the facility. The description of the occurrence and its cause shall include

PERMIT NO. HW-50289 CONTINUATION SHEET 12 OF 20

EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

[V.D.2.]

- a. name, address, and telephone number of the owner or operator;
- b. name, address, and telephone number of the facility;
- c. date, time, and type of incident;
- d. name and quantity of material(s) involved;
- e. the extent of injuries, if any;
- f. an assessment of actual or potential hazards to the environment and human health outside the facility, where this is applicable; and
- g. estimated quantity and disposition of recovered material that resulted from the incident:
- E. The Executive Director may waive the five-day written notice requirement as specified in 31 TAC §305.125(9) in favor of a written report submitted to the TWC within 15 days of the time the permittee becomes aware of the noncompliance or condition.
- F. An annual report must be submitted covering facility activities during the previous calendar year.
- G. Emissions from this facility must not cause or contribute to a condition of "air pollution" as defined in §382.003 of the Texas Clean Air Act or violate §382.085 of the Texas Clean Air Act. If the Executive Director of the TACB determines that such a condition or violation occurs, the permittee shall implement additional abatement measures as necessary to control or prevent the condition or violation.
- H. The provisions of this permit are severable, and if any provision of this permit or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.
- I. The permittee shall notify the TWC in writing within 10 days of the discovery of any release of hazardous waste or hazardous constituents that may have occurred from any solid waste management unit at the facility regardless of when the release occurred or may have occurred and regardless of when waste was placed in any unit. Release of hazardous waste or hazardous waste constituents from any solid waste management unit regardless of when waste was placed in that unit or when the release occurred, will constitute grounds for (1) a major permit amendment or modification pursuant to the Texas Solid Waste Disposal Act, TEXAS HEALTH AND SAFETY CODE, Chapter 361 (Vernon Supp 1990), as necessary to incorporate into the permit appropriate corrective action; (2)—the adoption by the TWC of a ground-water compliance plan; or (3) other action deemed necessary

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NAME: U.S. Air Force/Carswell Air Force Base

#### [V.I.]

by the TWC. Pursuant to such permit amendment, modification, ground-water compliance plan, or other order of action, the permittee shall then take timely corrective action for such releases.

The permittee shall notify the Executive Director in writing of any newly identified Solid Waste Management Unit(s) (SWMU) (i.e., a new unit not specifically identified during the RFA, discovered during the course of field investigation, environmental audits, or other means), no later than fifteen (15) calendar days after discovery.

\* If the release appears to have caused off-site contamination, the Director of the Hazardous Waste Division of Region VI of the U.S.E.P.A. must be included in all release activities required by the permit.

#### J. Waste Minimization

The permittee shall certify annually by October 1 for the previous year ending August-31, that the permittee

- has a program in place to reduce the volume and toxicity of all hazardous wastes which are generated by the permittee's facility operation to the degree determined to be economically practicable;
- 2. that the proposed method of treatment, storage, or disposal is that practicable method currently available to the permittee which minimizes the present and future threat to human health and the environment. The waste minimization certification is to be included in the operating records; and
- 3. has surveyed its plant processes and other sources of hazardous waste and has identified those that are listed on the TWC Annual Waste Summary. Within 210 days of the effective date of this permit, the permittee shall submit to the Executive Director a list of Waste Minimization Projects ("WMPs") that it has determined through its waste minimization review program may be implemented within the next five years.

Annually thereafter, the permittee shall submit to the Executive Director on or before the anniversary date of the permittee's first listing of WMPs, a report setting forth the following information:

a. The status of each listed WMP as of the date of the report including the quantity of each hazardous waste and the percentage of reduction together with a projection concerning the expected work or resources that may be devoted to each listed WMP during the next twelve months;

( 7

CONTINUATION SHEET 14 OF 20

PERMIT NO. HW-50289 EPA I.D. No. 0571924042

NAME: U.S. Air Force/Carswell Air Force Base

#### [V.J.3.]

- b. If any WMP has been deleted from the list previously submitted, the reason for such deletion; and
- c. A listing of any new or changed WMP that permittee's review program has developed since the last annual report.

The Executive Director may require the permittee to submit a more detailed status report for a specific WMP if it is unclear to the Executive Director the reasons the permittee has taken a particular action in regard to such WMP.

- K. The permittee shall comply with 40 CFR §266.23(b).
- L. The permittee is required to meet all performance standards in this permit, regardless of whether the permit also contains a specific design or other requirement relating to the performance standard.
- \*M. The permittee shall comply with the land disposal restrictions as found in 40 CFR Part 268 (Fed. Reg. November 7, 1986; June 4, 1987; July 8, 1987; August 17, 1988; June 23, 1989 and any subsequent applicable promulgations). Requirements include modifying the permittee's waste analysis plan, as necessary, to include analyses to determine compliance with applicable treatment standards or prohibition levels, pursuant to 40 CFR §§268.7(c) and 264.13(a).

#### VI. Incorporated Regulatory Requirements

- A. The following TWC regulations are hereby made provisions and conditions of this permit. Issuance of this permit with incorporated rules in no way exempts the permittee from compliance with any other applicable state statute and/or TWC Rule.
  - 1. 31 TAC Chapter 335 Subchapter A:
  - 2. 31 TAC Chapter 335 Subchapter B;
  - 3. 31 TAC §335.152:
  - 4. 31 TAC §§335.153-335.155; and
  - 5. 31 TAC §335.177.
- B. To the extent applicable to the activities authorized by this permit, the following provisions of 40 CFR Part 264, adopted by reference by 31 TAC §335.152, are hereby made provisions and conditions of this permit:

PERMIT NO. HW-50289 EPA I.D. No. 0571924042 CONTINUATION SHEET 15 OF 20

NAME: U.S. Air Force/Carswell Air Force Base

#### [VI.B.]

- Subpart B -- General Facility Standards;
- 2. Subpart C -- Preparedness and Prevention;
- 3. Subpart D -- Contingency Plan and Emergency Procedures;
- 4. Subpart E -- Manifest System, Recordkeeping, and Reporting;
- 5. Subpart G -- Closure and Post-closure; and
- 6. Subpart I -- Use and Management of Containers.

#### VII. Incorporated Application Materials

The permittee shall maintain the following documents at the facility and make them available for inspection by regulatory personnel.

#### A. Contingency Plan

The permittee shall follow the contingency plan, developed in accordance with 40 CFR Part §264, Subpart D, dated September 6, 1989, which is hereby approved subject to the terms of this permit and any other orders of the TWC. The contingency plan is hereby incorporated into this permit by reference as if set out fully herein. Any and all revisions to the plan shall become provisions and conditions of this permit upon the date of approval by the TWC.

#### B. Inspection Schedule

The permittee shall follow the inspection schedule, developed in accordance with 40 CFR §264.15, dated September 6, 1989, which is hereby approved subject to the terms of this permit and any other orders of the TWC. The inspection schedule is hereby incorporated into this permit by reference as if set out fully herein. Any and all revisions to the schedule shall become provisions and conditions of this permit upon the date of approval by the TWC.

#### C. Closure Plan

Facility closure shall be completed in accordance with the requirements of 31 TAC §335.152 and 40 CFR Part 264 Subpart G and the closure plan dated September 6, 1989, which is hereby approved subject to the terms of this permit and any other orders of the TWC. The closure plan is hereby incorporated into this permit by reference as if set out fully herein. Any and all revisions to the plan shall become provisions and conditions of the permit upon the date of approval by the TWC.

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PERMIT NO. HW-50289

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NAME: U.S. Air Force/Carswell Air Force Base

[VII.]

#### D. Waste Analysis Plan

The permittee shall follow the waste analysis plan developed in accordance with 40 CFR §264.13, dated August 21, 1990, which is hereby approved subject to the terms of this permit and any other orders of the TWC. The waste analysis plan is hereby incorporated into this permit by reference as if set out fully herein. Any and all revisions to the plan shall become provisions and conditions of this permit upon the date of approval by the TWC.

#### VIII. RCRA Facility Investigation

The permittee shall conduct a RCRA Facility Investigation in order to determine whether hazardous constituents listed in 40 CFR Part 264, Appendix IX have been released into the environment from the following SWMUs:

Carswell#	
<u>Unit No.</u>	<u>Description</u>
-16	Building 1060 - Waste Accumulation Area
18-	Fire Training Area No. 1
19	Fire Training Area No. 2
20	Waste Fuel Storage Tank
21	Waste Oil Tank
22	Landfill No. 4
23	Landfill No. 5
24	Waste Burial Area
28	Landfill No. 1
-32	Building 1410 - Waste Accumulation Area
<del>-</del> 35	Oil/Water Separation System
~36	Building 1191 - Waste Accumulation Area
53	Storm Water Drainage System
<u>-61</u>	Building 1320 - Power Production Maintenance
<del></del>	Facility Waste Accumulation Area
62	Landfill No. 6
63	Entomology Dry Well
64	French Underdrain System
65	Weapons Storage Area Disposal Site
67	Building 1340 - Oil/Water Separator
68	POL Tank Farm

#Unit numbers correspond to the nomenclature used in the RFA document for Carswell AFB.

A. As a part of the facility investigation, the permittee shall submit three copies of a workplan to the Executive Director of the TWC for approval and/or modification, and one copy to the Executive Director, Hazardous Waste Management Division, U.S.E.P.A. Region VI, within 90 days from the issuance date of this permit by the TWC, which will address in detail the following items:

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CONTINUATION SHEET 17 OF 20

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NAME: U.S. Air Force/Carswell Air Force Base

#### [VIII.A.]

- 1. A plan view drawing of the facility at a scale of 1 inch equal to not more than 200 feet which clearly shows the following information:
  - a. the locations, surface area and estimated depths of soils contamination associated with all RFI units.
  - b. the locations of all RFI units.
  - c. all structures adjacent or nearby all RFI units such as concrete pads, gullies and roadways; and
  - d. the drawing date, its orientation and scale.

In consideration of the enormity of this facility, the use of match lines on partial maps will be permitted.

- 2. Procedures for investigating all RFI units which, at a minimum, include the following elements:
  - a. methods of locating areal extent of soil contamination; and
  - b. a hydrogeological evaluation of each unit area which reflects the following scope:
    - (1) Performance of a hydrogeologic assessment of the area to characterize the uppermost aquifer beneath the unit. The applicant must produce a soil boring program which determines the strata encountered, saturated intervals and direction of ground-water flow. The workplan must specify the spacing, depth and locations of boreholes. Samples from borings must be taken continuously from the surface to a depth of 20 feet and then at 5-foot intervals thereafter until ground water is reached. Samples shall be described as to color, soil type according to the Unified Soil Classification System, other visual characteristics such as structure, texture. mineral composition, moisture, etc., and any visual or olfactory evidence of contamination. The workplan should specify that soil borings be conducted with an Organic Vapor Analyzer (OVA) to augment the sense of smell. Sample description shall be performed by a qualified geologist or geotechnical engineer. Samples submitted for chemical analysis must be collected every 5 feet from the surface to the bottom of the borings and be analyzed in accordance with the United States Environmental Protection Agency publication SW-846, Methods for Evaluating Solid Waste (USEPA SW-846) for

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[VIII.A.2.b.(1)]

- all Appendix IX constituents, unless a shorter list can be justified. If a shorter list is proposed the justification for same must be presented in the workplan.
- (2) Plans for installation of a ground-water monitoring system, based upon the results of the soil boring program, aconsisting of a minimum of one background well 'located hydraulically upgradient of the unit, removed a sufficient distance so as not to be affected by the unit, and at least three wells located on the downgradient perimeter of the unit. Exploratory boreholes which are developed may be converted to monitor wells if they are appropriately drilled and located. The plan should include procedures for determining the ground-water gradient. More than three downgradient perimeter wells may be required to effectively sample the uppermost aquifer for hazardous constituents and additional background wells are recommended in order to provide an adequate sample population for determining if background values have been exceeded. Procedures for installation of monitor wells which include detailed completion methods shall be submitted in the workplan. The upper 20 feet of the upper flow zone of the uppermost aquifer must be sampled by wells. No monitor well screen length shall exceed 20 feet. Well construction and sampling materials shall be selected to avoid sample analysis interference. Monitor wells shall be logged during installation according to approved procedures which are outlined in the workplan. If existing wells are utilized as part of the ground-water monitoring system, the permittee shall provide sufficient boring data or conduct additional soil borings to provide the information which will characterize the wells;
- (3) Well development methods. Methods of well development shall be described to ensure that any fluids introduced by drilling are removed and samples are not influenced by drilling activities.
- (4) Exact procedures for sampling and analysis of soil and water samples. The workplan shall include provisions for sample collection, sample preservation and shipment, analytical procedures, and chain of custody control. Statistical methods must be submitted that will be used to determine if a statistically significant

PERMIT NO. HW-50289 EPA I.D. No. 0571924042 CONTINUATION SHEET 19 OF 20

NAME: U.S. Air Force/Carswell Air Force Base

[VIII.A.2.b.(4)]

- "increase over background has occurred for soil and water samples. The plan shall include a schedule for collecting samples from monitor wells during 3 sampling events spaced at 2 month intervals and analyzed in accordance with USEPA SW-846 for all Appendix IX constituents, unless a shorter list can be justified. If a shorter list is proposed, the justification for same must be presented in the workplan.
- (5) A preliminary soils and ground-water report to be submitted as part of the workplan. This preliminary report shall contain, at a minimum, the following information regarding the soils and ground-water investigation:
  - (a) a site map having a one inch equals 50 feet scale, which depicts the locations of 1) all solid waste management units being investigated, 2) existing and proposed borings and monitor wells and 3) lines of proposed geologic cross-sections;
  - (b) plans and schedule for submitting the hydrogeologic information; and
  - (c) well construction diagram.
- (6) Four copies of Final Soils and Ground-water Report shall be submitted with the Facility Investigation report required by <u>Provision VIII.D.</u> which contains at a minimum the following information:
  - (a) contours of the ground-water surface based on measurements in piezometers and monitor wells, and apparent direction of ground-water flow;
  - (b) geologic cross-sections depicting the near-surface stratigraphy;
  - (c) logs of all soil borings and monitor wells; and
  - (d) results of analyses for soil and ground water. .
- 3. The permittee may elect to certify that no wastes with Appendix IX constituents have been managed in an RFI unit or units in lieu of performing the investigation procedures noted in <u>Provision VIII.A.2.</u> provided that confirming data are submitted.

PERMIT NO. HW-50289 EPA I.D. No. 0571924042 CONTINUATION SHEET 20 OF 20

NAME: U.S. Air Force/Carswell Air Force Base

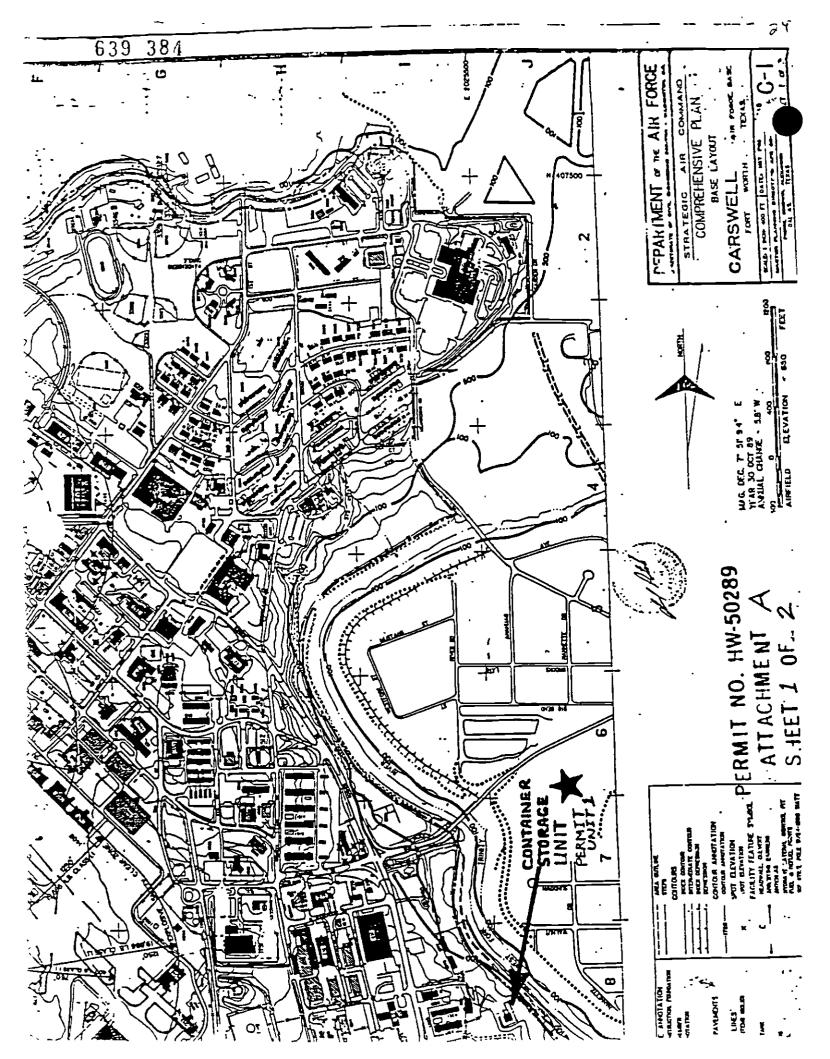
#### [VIII.A.]

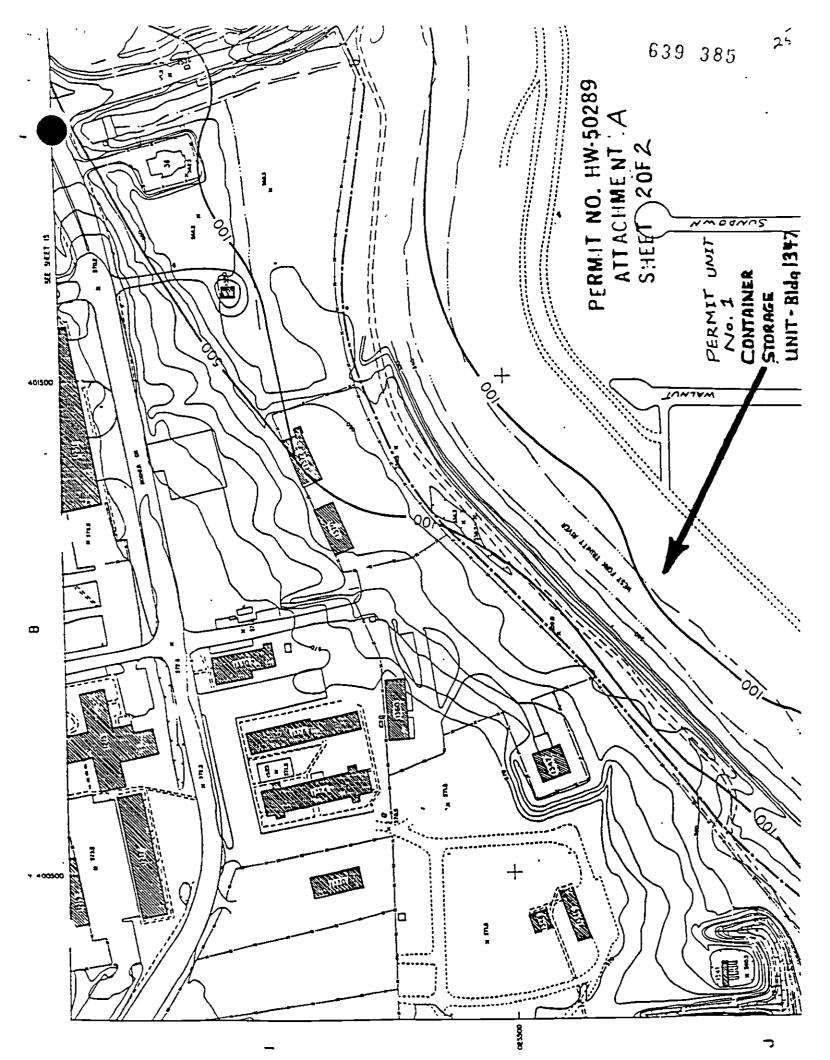
- 4. A time schedule including significant accomplishments for conducting the RCRA Facility Investigation activities not to exceed twelve months in duration.
- 5. A sample plan including sample locations, sampling methods, sampling equipment, sample handling procedures, analytical procedures, detection limits for each procedure, and sample quality assurance and quality control:
- 6. A safety plan describing the known hazards and risks identifying levels of protective clothing to be worn, describing decontamination procedures and identifying any special requirement or training needs.
- B. The permittee shall immediately implement the approved work plan upon receipt of written approval from the Executive Director of the TWC.
- C. The permittee shall notify the TWC District 4 Office in Duncanville, Texas at least 10 days prior to any sampling activity in order to afford District personnel the opportunity to observe sampling procedures and split samples.
- D. The permittee shall submit three copies of an RCRA Facility Investigation report to the Executive Director, and one copy to the Director, Hazardous Waste Management Division, U.S.E.P.A. Region VI, within 60 days after the completion of the Facility Investigation. This report shall contain the results of all inspections, observations, evaluations and sampling events conducted as a part of the Facility Investigation along with all maps, drawings and cross-sections.
- E. If it is determined by the TWC that there has been a release to the environment of hazardous constituents listed in 40 CFR Part 264, Appendix IX, the permittee shall apply to the Executive Director of the TWC for an amendment or modification to this permit in order to initiate a further investigation and/or corrective action. If there is evidence of off-site contamination, the permittee shall also apply for a modification to this permit to the Director of the Hazardous Waste Management Division, U.S.E.P.A., Region VI.

#### <u>Attachments</u>

A -- Legal Description

B -- Site Plan





## PERMIT NO. HW-50289

#### Cross Reference Chart

ATTACHMENT B SHEET I OFA //

	O'ILL' GIN
NR Waste Management Activity	
	•
Operating Unit	
1. 29. 700-gallon-capacity storage area	Original Tract (OT)
RFI Units	
0 D. (1) (1) - 1000 United Assessment Assessment	
2. Building 1060 - Waste Accumulation Area	
3. Fire Training Area No. 1	- A-102
4. Fire Training Area No. 2	<u>A-104</u>
5. Waste Fuel Storage Tank	A-102
6. Waste Oil Tank	A-102
7. Landfill No. 4	<u> E-501</u>
8. Landfill No. 5	<u>A-102</u>
9. Waste Burial Area	A-102
10. Landfill No. 1	· OT
11. Building 1410 - Waste Accumulation Area	ОТ
12. Oil/Water Separation System	
13. Building 1191 - Waste Accumulation Area	ОТ
14. Storm Water Drainage System	- A-101
15. Building 1320 - Power Production Maintenance-	
Facility Waste Accumulation Area	· E-508
16. Landfill No. 6	· E-508
17. Entomology Dry Well	
18. French Underdrain System	• E-530 and E-531
19. Weapons Storage Area Disposal Site	. G-700
20. Building 1340 - Oil/Water Separator	* E-537
21. POL Tank Farm	- OT

639 387 PERMIT NO. HW-50289
ATTACHMENT B

SHEET 2 OFL 11

one m

CARSWELL AIR FORCE BASE FORT WORTH, TARRANT COUNTY, TEXAS

ORIGINAL TRACT

ACREAGE: 5

#### Tracte I

A tract of land situated about 6 miles N. 80 W. from the Court in Tarrant County, Texas and embracing portions of the Jos B. Farmer D. V. Farmer, Cornelius Connelly, B. L. Samuel, Daniel McVean, J. M. Shreeve, and E. S. Terrell Surveys.

Beginning at a stake in the most southerly south line of the s S. Terrell Survey 103 feet from its south southwest corner, a City monument bears west 128 feet.

Thence north no degrees 07 minutes west 4225-82/100 feet to a Thence north 31 degrees 15 minutes east 389-1/10 feet to a state of the north no degrees 5-1/2 minutes east 1807-9/10 feet to a in the north line of the said E. S. Terrell Survey; thence north 89 degrees 37 minutes east 4-3/4 feet to a monument.

Thence south 45 degrees 27 minutes east 212-7/10 feet to a La Worth monument.

Thence north 89 degrees 43 minutes east 150 feet to a Lake Wo

Thence north 44 degrees 30 minutes east 212-8/10 feet to a La Worth monument, in the said north line of said Terrell Survey.

Thence north 89 degrees 36 minutes east along said line, 1449 feet to a Lake Worth monument at the northeast corner of said Terror Survey in the west line of the Daniel McVean Survey.

Thence north along said line 834-4/10 feet to a Lake Worth month is degrees 45 minutes east 437-8/10 feet to a L. Worth monument.

Thence north 87 degrees 25 minutes east 95-3/10 feet to a La monument.

Thence south 66 degrees 13 minutes east 137-7/10 feet to a L Worth monument.

Thence south 54 degrees 05 minutes east 415-8/10 feet to a I Worth monument.

Thence south 24 degrees 56 minutes east 561-1/10 feet to a I Worth monument.

Thence south 60 degrees east 277-8/10 feet to a Lake Worth r Thence north 82 degrees 03 minutes east 1387 feet to a Lake monument in the east line of the said McVean Survey, the west line said D. V. Farmer Survey.

Thence north 61 degrees 54 minutes east 1384-8/10 feet to a Worth monument in the north line of the said D. V. Farmer Survey.

Thence along said line north 89 degrees 35 minutes east 178 feet to a stake from which a City monument bears south 15 feet, s monument numbered 218.

Thence south 7501-55/100 feet to a stake from which a City number 190 bears north 15 feet.

vey.

PERMIT NO. HW-50289

CARSWELL AIR FORCE BASE FORT WORTH, TEXAS

ATTACHMENT B SHEET 3 OF //

TRACT NO. A-101

TARRANT COUNTY, TEXAS

A tract of land situated in the County of Tarrant, State of Texas, being part of the J. M. Shreeve Survey (A-1456) and being more particularly described as follows:

From the northwest corner of said J. M. Shreeve Survey east, 2310 feet to the point of beginning, said point being the northwest corner of the Noel R. Bailey, et ux, property; thence along the common line between the property of Noel R. Bailey, et ux, and the existing U. S. Government property east, 250 feet to a point; thence south, 753.4 feet to a point in the south boundary line of said Noel R. Bailey, et ux, property; thence along the common line between the property of Noel R. Bailey, et ux, on the right and the properties of Mrs Patricia Harris and Gatlin Mitchell on the left, west 250 feet to the southwest corner of said Noel R. Bailey, et ux, property; thence along the common line between the property of Noel R. Bailey, et ux, and the existing U. S. Government property north 753.4 feet to the point of beginning, containing 4.32 acres, more or less.

and being part of the same land conveyed to Noel R. Bailey, et ux, by George R. Shepherd, et ux, by deed dated 27 November 1948 and recorded in Vol 2048 at Page 550 of the Deed Records of said Tarrant County.

PERMIT NO. HW-50289 ATTACHMENT B

CARSWELL AIR FORCE BASE FORT WORTH, TARRANT COUNTY, TEXESTEET 4 OF //

TRACT NO. A-102

ACREAGE: 22.9

Three waste sites, known as "Landfill 5," "Landfill 7," and "waste burial area" respectively, as approximately located on a tract of land, being 22.9 acres, more or less, being part of the J. M. SHREEVE SURVEY (A-1456), recorded in Vol 2576 at Page 233 of the Deed Records of said Tarrant County, and being more particularly described as follows:

From the intersection of the north right-of-way line for White Settlement Road, with the west boundary line of said J. M. SHREEVE SURVEY, east 1640 feet to the point of beginning, said point being the southwest corner of the Gatlin Mitchell property; thence along the common line between the property of Gatlin Mitchell and the existing U.S. Government property and Noel R. Bailey, et ux, property on the left, east 874.2 feet to the northeast corner of said Gatlin Mitchell property; thence along the common line between the Gatlin Mitchell and the Mrs. Patricia Harris properties south, 1145.8 feet to the southeast corner of said Gatlin Mitchell property, said point being in the north right-of-way line for White Settlement Road; thence along said north right-of-way line for White Settlement Raid west, 874.2 feet to the point of beginning, containing 22.9 acres, more or less,

and being substantially the same land conveyed to Gatlin Mitchell by Jesse E. Martin by deed dated 19 September 1946 and recorded in Vol 1837 at Page 455 of the Deed Records of said Tarrant County.

639 390

PERMIT NO. HW-50289

FORT WORTH, TEXAS

CARSWELL AIR FORCE BASE ATTACHMENT B SHEET 5 OF 11

TRACT NO. A-104

ACREAGE: 56.2

A Tract of land situated in the County of Tarrant, State of Texas, being part of the J. M. Shreeve Survey (A-1456) and part of the John Collett Survey (A-262) and being more particularly described as follows:

From the intersection of the south right-of-way line for White Settlement Road with the west boundary line of said J. M. Shreeve Survey. east 1205 feet to the point of beginning, said point being the northwest corner of the W. Coulsting property in said south right-of-way line for White Settlement Road; thence along said south right-of-way line for White Settlement Road, south 89 deg. 35' east, 1128.5 feet to a point; thence south 00 deg. 10' east, 2170.3 feet to a point in the south boundary line of said W. Coulsting property; thence along the common line between the W. Coulsting and the Texas Electric Service Co. properties north 89 deg. 25' west, 1128.5 feet to the southwest corner of said W. Coulsting property; thence along the common line between the W. Coulsting and the R. L. Carlock, Jr., et al, properties north 00 deg. 10' west, 2168.3 feet to the point of beginning, containing 56.2 acres, more or less,

and being part of the same land conveyed to W. Coulsting by Mrs Mary E. Farmer by deed dated 15 October 1921 and recorded in Vol 723 at Page 354 of the Deed Records of said Tarrant County.

# PERMIT NO. HW-50289 ATTACHMENT B

CARSWELL AIR FORCE BASE SHEET 6 OF2 //
FORT WORTH, TARRANT COUNTY, TEXAS

TRACT NO. E-501

ACREAGE: 54.8

A tract of land situated in the County of Tarrant, State of Texas, being part of the John M. Shreeve Survey (A-1456) and part of the John Collett Survey (A-262), and being more particularly described as follows:

From the southeast corner of the JOHN M. SHREEVE SURVEY south 67 deg. 27' west, 1081 feet to the point of beginning, said point being the southernmost southeast corner of said W. Coulsting property and the southwest corner of the White Settlement Common Consolidated School District No. 37 property, and being also in a north line of the Wherry Housing Project property; thence along the common line between said Coulsting and the Wherry Housing Project property north 89 deg. 22' west. 432 feet to the southwest corner of the W. Coulsting property, the same being also in the existing military reservation boundary line for Carswell Air Force Base; thence along the common line between the said W. Coulsting property and the said military reservation boundary line north 00 deg. 10' west, 2170.3 feet to a point in the southerly right-of-way line of White Settlement Road; thence along said southerly right-of-way line south 89 deg. 35' east, 1427 feet to a point, same being the northeast corner of said Coulsting property and the northwest corner of the Rhea J. Vernon property; thence along the common line tetween said Coulsting property on the right and the Rhea J. Vernon and the wherry Housing project properties --on the left south 00 deg. 10' east, 1165 feet, more or less, to a point, same being the easternmost southeast corner of said Coulsting property and the northernmost corner of the White Settlement Common Consolidated School District No. 37: thence along the common line between said Coulsting and the White Settlement School properties as follows:

south 74 deg. 15; west, 40.1 feet to a point of curve; thence along the arc of a curve to the left in a southwesterly direction 176.5 feet to point of tangency; thence south 13 deg. 20; west, 63.7 feet to point of curve; thence along the arc of a curve to the right in a southwesterly direction 146.5 feet to a point; thence north 89 deg. 22; west, 788.7 feet to a point, same being a reentrant corner for said Coulsting property and the northwest corner of said White Settlement School property; thence south 00 deg. 38; west, 696.4 feet to the point of beginning and containing 54.8 acres, more or less,

and being a part of the same land conveyed to W. Coulsting by Mrs. Mary E. Farmer by deed dated 15 October 1921 and recorded on Vol 723 at Page 354 of the Deed Records of Tarrant County, Texas.

PERMIT NO. HW-50289

ATTACHMENT B

FORT WORTH, TARRANT COUNTY, TEXASTEET 7 054

TRACT NO. E-508

ACREAGE: 6.18

A tract of land situated in the County of Tarrant, State of Texas, being part of the B. L. Samuel Survey (A-1467) and part of the John M. Shreeve Survey (A-1456), and being more particularly described as follows:

From the northeast corner of the JOHN M. SHREEVE SURVEY and along the north line of same west 329.5 feet to the point of beginning, said . point being at the intersection of the northeasterly right-of-way line of Westover Road with the existing military reservation boundary line of Carswell Air Force Base, and being the Westernmost corner of the Dr. Robert C. Botts, et ux, property; thence along the common line between the said Dr. Botts, et ux, property and said military reservation boundary line east 806.5 feet to a point same being the northeast corner of the said Dr. Botts, et ux, property and being also the northwest corner of the William J. Bailey property, same being west 30 feet from the east line of the B. L. SAMUEL SURVEY; thence along the common line between the said Dr. Botts, et ux, and the William J. Bailey properties, same being 30 feet west of and parallel to the east line of said SAMUEL SURVEY south 00 deg. 50' east, 668 feet to a point in the northeasterly right of way line of said Westover Road, same being the southeast corner of said Dr. Botts. et ux, property; thence along the northeasterly right of way line of said Westover Road north 50 deg. 42' west, 1054.7 feet to the point of beginning and containing 6.18 acres, more or less,

and being substantially the same land conveyed to Dr. Robert C. Botts, et ux, by P. A. Taliaferro, et ux, by deed dated 5 April 1949 and recorded in Vol 2077 at Page 543 of the Deed Records of Tarrant Count, Texas.

### PERMIT NO. HW-50289

ATTACHMENT B

FORT WORTH, TARRANT COUNTY, TEXAS HEET 8 05. //

TRACT NO. E-530

ACREAGE: 13.54

A tract of land situated in the County of Targant, State of Texas, being part of the Cornelius Connelly Survey (A-319), and being more particularly described as follows:

From the southeast corner of the J. B. Farmer Survey (A-514) south 30 deg. 11' west, 590 feet to the point of beginning, said point being the northeast corner of the Mrs Kate M. Hyde property, and being also in the west line of the Sidney T. Oates property and the existing boundary line of Carswell Air Force Base property; thence along the common line between said Mrs Kate M. Hyde and the Sidney T. Oates properties south, 930 feet to a point, same being the southeast corner of said Mrs Kate M. Hyde property and the northeast corner of the Homer Priddy property: thence along the common line between said Mrs Kate M. Hyde and the Homer Priddy properties west, 710.2 feet to the southwest corner of the Mrs Kate Hyde property and northwest corner of the Homer Priddy property, the same being in the east right-of-way line of River Lake Road as widened by the United States of America, Bureau of Public Roads, the said east right-of-way line being the east line of that certain tract acquired by the United States of America, Bureau of Public Roads from Mrs Kate M. Hyde in Civil Action No. 2537-In the Federal District Court for the Northern District of Texas; thence along the east right-of-way line of the widened River Lake road as follows: north 06 deg. 00' east, 179.26 feet to a point: thence north 20 deg. 02' (east, 103.1 feet to a point; thence north 05 deg. 20' west, 152.97 feet to a point; thence north 06 deg. 00' east. 92, 6 feet to a point; thence north 11 deg. 50' east, 108.64 feet to a point; thence north 23 deg. 31' east, 108.64 feet to a point; thence north 29 deg. 22' east, 233.72 feet to a point in the existing boundary line for said Carswell Air Force Base Property, same being the northwest corner of said Mrs Kate M. Hyde property; thence departing from said right-of-way line and along said boundary line, same being the common line between said Mrs Kate M. Hyde and Carswell Air Force Base properties, east, 474.18 feet to the point of beginning, containing 13.54 acres, more or less.

and being a part of the same land conveyed to Mrs Kate M. Hyde by Sidney T. Oates by deed dated 10 April 1945 and recorded in Vol 1876 at Page 293; to Mrs Kate Hyde by Betty Gordon chosen by deed dated 1 April 1935 and recorded in Vol 1449 at Page 245; and to Mrs Kate Hyde by E. G. Rosen, et al by deed dated 22 May 1945 and recorded in Vol 1876 at Page 292 of the Deed Records of Tarrant County, Texas.

CARSWELL AIR FORCE BASE FORT WORTH, TARRANT COUNTY, TEXAS

PERMIT NO. HW-50289 35 ATTACHMENT B SHEET 9 OF. //

TRACT NO. F-531

ACREAGE: 12.20

A tract of land situated in the County of Tarrant, State of Texas, being part of the Cornelius Connelly Survey (A-319) and being more particularly described as follows:

From the southeast corner of the J. B. Farmer Survey (A-514) south. 367 feet to the point of beginning, said point being the northernmost northeast corner of the Sidney T. Oates property and being also in the west line of the Grace Cozby property; thence along the common line between said Sidney T. Oates property on the right and the Grace Cozby, the Lois Trigg, and the Eugene Sergi properties on the left south, 1220 feet to a point, same being a reentrant corner of said Oates property and the southwest corner of the said Eugene Sergi property, said point being the southwest corner of Lot No. 13 in the Winding Brook Addition to Westworth Village, Tarrant County, Texas; thence along the common line between said Sidney T. Oates and the Sergi properties east, 228.1 feet to a point, same being the easternmost northeast corner of said Oates property and southeast corner of said Sergi property, and being also the southeast corner of Lot No. 13 of said Winding Brook Addition and located in the west right of way line of Winding Brook Drive; thence along said west right of way line of south, 180 feet to a point, same being the easternmost southeast corner of said Oates property and the northeast corner of Lot No. 6 of said addition; thence along the common line between said Sidney T. Oates and the Evelyn Oates properties west, 226.5 feet, to a point, same being a reentrant corner of said Cates property and the northwest corner of Lot No. 9 of said addition; thence along the common line between said Oates property on the right and the said Evelyn Oates and the County of Tarrant properties on the left south, 199.7 feet to a point, same being the southernmost southeast corner of the Sidney T. Oates property in the south right-of-way line of Oates Drive; thence west, 306.2 feet to a point, same being the southwest corner the Sidney T. Oates property, and the southeast corner of the C. R. Lees property; thence along the common line between said Oates property on the right and the C. R. Lees, the H. C. Thomas, the Homer Priddy, the Mrs Kate M. Hyde, and the Carswell Air Force Base properties on the left north, 1603 feet to a point, same being the northwest corner of said Oates property and being in the existing boundary line of said Air Force Base; thence along the common line between said Oates and Air Force Base properties east, 306,2 feet to the point of beginning and containing 12.20 acres, more or less,

and being substantially the same land conveyed to Sidney T. Oates, et ux by Betty Gordon Rosen by deed dated 1 April 1935 and recorded in Vol. 1246 at Page 43 and being the same land conveyed to Sidney T. Oates, et ux by Betty Gordon Rosen by deed dated 1 September 1934 and recorded in Vol. 1221 at Page 25 and being substantially the same land conveyed to Sidney T. Oates by E. G. Rosen, et al by deed dated 18 May 1939 and recorded in Vol. 1395 at Page 229 and being a part of the same land conveyed to Sidney T. Oates et ux by Lois Trigg, independent executrix of will and estated of Ross Trigg by deed dated 17 March 1952 and recorded in Vol. 2411 at Page 232 of the Deed Records of Tarrant County, Texas.

35

PERMIT NO. HW-50289

ATTACHMENT B

CARSWELL AIR FORCE BASE FORT WORTH, TARRANT COUNTY, TEXAS TEET 10 OF 11

TRACT NO. E-537

ACREAGE: 22.75

A tract of land situated in the County of Targant, State of Texas, being part of the Nathaniel H. Carroll Survey (A-264), and part of the Cornelius Connelly Survey (A-319), and being more particularly described as follows:

From the southeast corner of the J. B. Farmer Survey (A-514) and along the east line of said survey north, 416.6 feet to the point of beginning, said point being the northwest corner of the Grace Cozby property, and being also in the existing boundary line of Carswell Air Force Base; thence along said boundary line, same being the common line between said Grace Cozby and the Carswell Air Force Base properties east. 590 feet to a point, same being the northeast corner of said Grace Cozby property and the northwest corner of the Mattie Belle McNaughton property: thence along the east line of said Grace Co2by property as follows: south, 1616 feet to a point, same being the easternmost southeast corner of said Cozby property; thence west, 25 feet to a point; thence south, 69.7 feet to a point, same being the southernmost southeast corner of said Cozby property and the northeast corner of the Winding Brook Addition according to a plat and dedication recorded Vol.388-K, Page 219; thence departing from east-line and along the common line between said Grace -Cozby property on the right and the Garland B. Franklin, et ux, and the Lois Trigg properties on the left west 540.4 feet to a point, same being the southwest corner of said Cozby property and the northwest corner of said Lois Trigg property, and being also in the east line of the Sidney T. Oates, et'ux, property; thence along the common line between said Grace Cozby property on the right and the Sidney T. Oates, et ux, and the Carswell Air Force Base properties on the left north, 1680.8 feet to the point of beginning and containing 22.75 acres, more or less,

and being substantially the same land conveyed to Grace Cozby by Lois Trig by deed dated 5 November 1951 and recorded in Vol 2369 at Page 543 of the Deed Records of Tarrant County, Texas.

36.

### PERMIT NO. HW-50289

CARSWELL AIR FORCE BASE ATTACHMENT B
FORT WORTH, TARRANT COUNTY, TEXASHEET // OF //

TRACT NO. G-700

)

ACREAGE: 247

A tract of land situated in the County of Tarrant, State of Texas, being part of the following surveys: F. W. SCHOEVERLING (A-1398), E. CATHEY (A-392), SOCORRO FARM CO. (A-1840), J. M. RICE (A-1799), S. B. HOPKINS (A-673), G. B. KENNEY (A-902), E. L. ALFORD (A-2000) and J. P. WOODS (A-1886), and being more particularly described as follows:

From the northeast corner of the G. B. Kenney Survey situated in the south line of the E. L. Alford Survey south 59 deg. 10' west, 755 feet to the point of beginning; thence north 05 deg. 25' east, 1840 feet to a point; thence north 50 deg. 53' east, 1120 feet to a point; thence north 89 deg. 21' east, 1885 feet to a point; thence south 47 deg. 45' east, 1145 feet to a point; thence south 02 deg. 05' east, 1380 feet to a point; thence east, 170 feet to a point; thence south 200 feet to a point; thence west, 330 feet to a point; thence south 38 deg. 40' west, 1200 feet to a point; thence south 87 deg. 20' west, 1360 feet to a point; thence south 89 deg. 44' south 87 deg. 20' west, 1360 feet to a point; thence south 89 deg. 44' west, 1013 feet to a point; thence north 39 deg. 04' west, 860 feet to the point of beginning, containing 247 acres, more or less.

John Hall, Chairman

Paus Reed, Commissioner

Pegty Garner, Commissioner

Anthony Urigaby, Executive Director



#### TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Freezeing Texas by Reducing and Preventing Pollution

Abril 22, 1994

Mr. Ohlen Long
Site Manager
Headquarters, Air Force Base Disposal Agency
Location H, Bldg 1215
Carswell Air Force Base, Texas 76127-5000

RE: Chrevell Air Force Base,
Taxas Natural Resource Conservation Commission Hazardous Waste
Farmit No. HM50289,
Schlid Waste Registration No. 65004,
EFA ID NO. TX0571924042,
Identification of additional Solid Waste Management Units
requiring investigation under part VIII of the Resource
Conservation and Recovery Act (RCRA) permit.

#### Request for Additional Investigation

Dear Mr. Long:

The Taxas Natural Resource Conservation Commission (TNRCC), formerly the Taxas Water Commission (TWC), Corrective Action Staff, has identified 21 SWMU's that require investigation and are not listed in the RCRA permit. Part V. I. of the permit allows the TNRCC to require investigation of units where a release may have occurred. Also, to Texas Administrative Code (TAC) \$105.62 (d) states that "If good cause exists, the executive director may initiate and the Commission may order an emendment to a permit and the executive director may request an updated application if necessary".

In order to expedite the investigative process the TNRCC will not require a permit amendment for the additional SWMU's until after the first phase of the investigation is completed. The investigation must follow the RFI procedures listed in part VIII of the parmit. After the first phase of the investigation, Caravell AFE may be required to amend the permit to add those SWMU's that are shown to have released industrial solid waste or municipal hazardous waste to the environment. The SWMU's that require additional investigation are listed below with SWMU numbers that correspond to the nomenclature used in the RCRA Facility Assessment (RFA) showment for Caravell AFB:

FO. Box 13087 . Austin, Texas 78711-3087 . 512/905-1000

Mr. Long 21 SWMU's Page 2 of 2

ewril e	Description
· <b>5</b>	Building 1628 Waste Accumulation Area
6	Building 1628 Washrack and Brain
7	Building 1628 Oil Water Separator
À	Building 1628 Sludge Collection Tank
6 7 8 12	Building 1519 Wasta Accumulation Area
25	Landfill No. 4
49 54	Landfill No. 3
26	
27	LandSill No. 10
29	Landfill No. 2
30	Landfill No. 9
·31	Building 1950 Waste Accumulation Area
33	Building 1420 Waste Accumulation Area
33 37	Building 1191 Oil Water Separator System
41-	Building 1414 Oil Water Superator System
42	Building 1414 Waste Accumulation Area
43	Building 1414 NDI Wasto Accusulation Point
·51	Building 1190 Central Wasta Holding Area
52	Building 1190 Oil Water Separator System
54	Storm Water Interceptors
	East Gate Oil Weter Separator
55	Mist Cats Oll Meter Debetfor
59	Building \$503 Waste Accumulation Area

Please submit RFI work plans for the units listed above no later than 90 days from the date of this letter. If you have any questions or require further information concerning this matter please contact Mr. Cacil Irby of my staff at (812) 239-2345.

Sinceraly,

Paul Lawis, Hanager

Corrective Action Section

Industrial and Hazardous Weste Division

PL:ci/ci

cc: David Welsigh, EFA Region 6 Don C. Eubank, TNRCC Region 4 Watto Wheatlay, TNRCC Permits Seventeen (17) of the SWMU's noted for RFI's on the attached table are also designated for RFI's in Carsvell's Hazardous Waste Permit No. 50289. Another 21 of the SWMU's vers designated for RFI's in TNRCC's letter dated April 22, 1994. However, the RFI required in TNRCC's letter of April 22, 1994, for SWMU No. 43 (Bldg. 1414. Non-Destructive Inspection Waste Accumulation Area) is hereby revised to NFA, based upon further TNRCC inspection and review. TNRCC's letter dated November 30, 1994, required RFI's for SWMU No. 45 (Bldg. 1027) and SWMU No. 47 (Bldg. 1015) in addition to nine (9) AOC's. Eleven (11) additional SWMU's (No. 11, 17, 14, 39, 40, 44, 49, 50, 58, 60, and 66) are designated for RFI's by this letter. A total of 14 AOC's are identified for investigation. Waste Oil Dump at DP-17 was designated for NFA by TNRCC's letter dated September 22, 1993. The attached table lists the TNRCC's designation for each specific SWMU/AOC, as of February 16, 1995.

Those waste management units identified as SWMU's in the 1989 RFA and designated for an RPI in this letter require an investigation in accordance with Provision VIII of Hazardous Waste Permit No. 50289. In order to expedite the investigative process, the TNRCC will not require a permit amendment for the additional sWMU's until after the first phase of the investigation is completed. After the first phase of the investigation, Carsvell AFB may be required to amend the permit to add those SWMU's that are shown to have released industrial solid waste or municipal hazardous waste to the environment.

The magnitude of the investigation for SWMU and AOC will depend on the unit's/area's size, condition, siting characteristics, and the constituents it managed. Those investigations and/or corrective actions already initiated need not be repeated, unless requested elsewhere. Please provide a schedule for submittal of the RFI Work Plans with a prioritization of the tasks and the rationale for the prioritization within 60 days of receipt of this letter.

The THRCC looks forward to assisting the Air Force and Mavy in developing the scope of work necessary to economically and adequately characterize releases to the environment. If you have any questions or need further assistance with this matter, please contact Mr. Geoffrey Meyer in my section at (512) 239-2577.

Sincerely,

Paul Lovis, Manager

Corrective Action Section

Industrial and Hazardous Waste Division

Enclosure

PL: gra

David Helaigh,

David Neleigh, EPA Ragion 6 Don C. Eubank, THRCC Region 4 Charles Mauk, THRCC Permits Wade Wheatley, THRCC Permits

co: Tannia Larson, IHW Corrective Action Section (CA070/103)

John Hall, Chairmen

Pam Reed, Commissioner

Teggy Garner, Commissioner

Dan Pearson, Executee Director



#### TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Prepariting Pollution

March 2, 1995

Mr. Ohlen Long Site Manager Headquarters, Air Force Base Disposal Agency Location H. Bldg. 1215 Carsvell Air Force Base, Texas 76127-5000

RE: Carswell Air Force Base,

Texas Natural Resource Conservation Commission Hazardous

Waste Permit No. HW50289,

Solid Waste Registration No. 65004,

EPA ID NO. TX0571924042,

Designation of solid Waste Management Units and Areas of Concern for Investigation and/or Corrective Measures

#### Determination of a Need for an RFI and Current condition Report

Dear Mr. Long:

The TNRCC has recently completed its review of the 68 RCRA Solid Wasta Management Units (SWMU) and 15 Areas of Concern (AOC) identified to date on Naval Air Station Fort Worth, also known as Carswell Air Force Base. Our review included the RCRA Facility Assessment (RFA) conducted in 1989; Hazardous Waste Permit No. 50289 issued in 1991; TNRCC's letter dated April 22, 1994; and the decisions resulting from the TNRCC's inspections of June 15, 1994, July 29, 1994, and February 13, 1995. Part V. I. of the permit allows the TNRCC to require investigation of units where a release may have occurred. Also, 30 Texas Administrative Code (TAC) \$305.62 (d) states that \*If good cause exists, the executive director may initiate and the Commission may order an amendment to a permit and the executive director may request an updated application if necessary.

Based on the above mentioned documents and inspections, the TNRCC has determined that a total of 50 SWNU's and 14 AOC's require investigations and/or corrective measures. The 18 remaining SWNU's and one AOC are designated for No Further Action (NFA) at this time. The NFA designation will remain so long as there is no further evidence of a release to the environment from these units.

#### Attachment

#### SWMU and AOC Designation Carswell Air Force Base / Naval Air Station Ft. Worth February 16, 1995

1	Pathological Weste Incherator	NFA
2	Pathological Waste Storage Shed	NFA
3	Metal Cans	NFA
4	Facility Dumpsters	NFA
5	Bidg. 1626 Wasta Accumulation Area	RFI
6	Bidg, 1625 Wash Rack and Drain	RFI
7	Bidg. 1625 Oll/Water 6aparetor	RFI
8	Bidg. 1628 Studge Collection Tank	RFI
9	Bidg. 1525 Work Station Weste Accumulation Area	NFA
10	Bidg. 1617 Work Station Waste Accumulation Area	NFA
11	Bidg. 1817 Waste Accumulation Area	RFI
12	Bidg. 1819 Waste Accumulation Ares	RFI
13	Bidg. 1710 Waste Accumulation Area	RFI
14	Bidg. 1060 Bead Blaster Collection Tray	NFA
15	Bidg. 1060 Paint Booth Vault	NFA
18	Bidg. 1060 Waste Accumulation Area	RFI
17	LendSit No. 7	RFI
18	Fire Training Area No. 1	NFA
19	Fire Training Area No. 2	RFI
20	Weste Fuel Storage Tank	RFI
21	Wade Of Tank	RFI .

#### Attachment

#### SWMU and AOC Designation Carewell Air Force Base / Naval Air Station Ft. Worth February 16, 1995

		N. T. S. T.
22	Landill No. 4	RFI
23	Landill No. 5	RFI
24	Waste Buriel Area	RFI
25	Landtil No. 8	RFI
25	Landali No. 3	RF1
27	Landfill No. 10	RFI
28	Landill No. 1	RPI
29	Landfill No. 2	RFI
30	Lendill No. 9	RFI
31	Bldg. 1050 Weste Accumulation Ares	RFI
32	Bidg, 1410 Waste Accumulation Area	RFI
13	Bldg. 1420 Weste Accumulation Area	RFI
34	Bidg. 1194 Weste Accumulation Area	RFI
35	Bidg, 1194 Vehicle Refueling Shop OliWater Separation System	,RFI
36	Bidg. 1191 Wade Accumulation Area	RFI
37	Bidg. 1191 Vehicle Maintenance Shop Oli/Water Separator	RFI
38	Bidg. 1269 PCB Transformers Building	NFA
39	Bidg. 1643 Waste Accumulation Area	RFI
40	Bidg. 1643 Olivialer Separation System	RFI
41	Bidg. 1414 Oll/Water Separation System Field Maintenance Squadron Aerospace Ground Equipment	RFI
42	Bidg, 1414 Waste Accumulation Area	RFI
43	Bidg. 1414 Non-Destructive inspection (NDI) Waste Accumulation Area	NFA

#### SWMU and AOC Designation Carswell Air Force Base / Naval Air Station Ft. Worth February 16, 1995

и	Bidg. 1927 OliMeter Separation Sysylem at the Aircraft Washing Hanger	RA
46	Bldg. 1027 Waste Oil Tank Vault at the Aircraft Washing Hanger	RFI
46	Bidg, 1027 Waste Accumulation Area	NFA
47	Bidg, 1015 Jet Engine Tast Cell OS/Water Separator	क्षा
48	Bldg. 1048 Fuel System Floor Drains	NFA
49	Aircraft Washing Area No. 1	RFI
50	Africatt Washing Area No. 2	RA
51	Bldg. 1190 Central Waste Holding Area	RFI
52	Bldg. 1190 Oli/Water Separation System	RFI
53	Storm Water Drainage System	, RFI
54	Storm Water Interceptors	RFI
55	East Gate Of/Weter Separator	RFI
<b>58</b>	Bidg. 1405 Waste Accumulation Area	NFA
57	Bidg. 1432/1424 Weste Accumulation Area	NFA
58	Posticide Rinse Ares	RFI
50	Bidg, 8503 Weepons Storage Area Weste Accumutation Area	RFI
60	Bidg. 8503 Radioactive Waste Burist Site	RFI
61	Bidg. 1320 Power Production Maintenance Facility Waste Accumulation Area	RFI
62	Land(II) No. 6	RFI
63	Entomology Dry Well	NFA
64	French Underdrein System	RFI
65	Weapons Storage Area Disposal Site	NFA

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#### SWMU and AOC Designation Carswell Air Force Base / Naval Air Station Ft Worth February 16, 1995

86	Sanitary Sewer System	RFI
67	Bidg. 1340 Oll/Water Separator	RFI
65	POL Tank Farm	RFI
AOC	ST-15, Bldg. 1518 Service Station	RFI
AOC	OT-18, Airfield TCE Plume	RFI
AOC	OP-17, Waste Oil Dump	NFA
AOC	Fuel Hydraut System	RFI
AGC	Grounds Maintenance Yard	RFI
AOC	RV Parking Area	RFI
AOC	Boss Refueling Area	RFI
AOG	SW Aemspace Museum	RFI
AOC	Golf Course Maintenence Area	RFT
AOC	Bidg, 1064 OlivWater Separator	RFI
AOC ·	Bidg, 1060 Oll/Water Separator	RFI
AOC	.Bidg. 4210 Oil/Water Separator	RFI
AOC	Bidg. 1145 Oil/Water Separator	RFI
AOC	Unnamed Stream	RFI
AOC	Bidg. 1190 Storage Shed	RFI

# TAB

Appendix B

#### APPENDIX B

## APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Table B.1
Preliminary Identified ARARs
NAS Fort Worth JRB, Texas

ARAR Category	Federal Act	Regulation/ Standard/Code	Description	E Comments
Location Specific	National Environmental Policy Act (NEPA)	40 CFR 1500	Council on environmental quality regulations	Evaluates impacts of remediation on the environment
		40 CFR 6	EPA NEPA regulations	Regulations specific to EPA actions
		32 CFR 989	DOD-Air Force NEPA	Regulations specific to DOD-Air Force
		32 CFR 265	regulations DOD-Natural Resources Programs	actions; the Air Force must evaluate and disclose impacts that will occur as a result of remediation
	National Historic Preservation Act (1966)	36 CFR 60, 62, 63, 65, 800	Culture resources regulations	Regulations pertaining to the protection of cultural resources. Includes Executive Order 11593
	Archaeological Resources Protection Act (1979)	36 CFR 296	Cultural resources regulations	Regulations pertaining to the protection of cultural resources. Includes Executive Order 11593
	Archaeological and Historical Preservation Act (1974)	40 CFR 6.301	Cultural resources regulations	Provides for data collection/ preservation listing on the National Registry of National Landmarks, etc. If any building and/or other landmarks/ resources are considered
ľ				eligible, compliance must be accomplished prior to remediation.
	Floodplains/Wetlands	E.O. 11988 E.O. 11990	Floodplain Management Protection of Wetlands	Executive orders adopted to avoid long and short term impacts associated with wetlands destruction and occupancy and modification of floodulains

Table B.1 (continued)
Preliminary Identified ARARs
NAS Fort Worth JRB, Texas

ARAR Category	Federal Act	Regulation/ Standard/Code	Description	Comments
Location Specific (continued)	Migratory Bird Treaty Act	16 U.S.C. 703-712 50 CFR 10, 20, and 21	Regulates the taking of migratory birds	This act prohibits the "taking" of migratory birds without a permit. Accidental killing of birds by pollution from CAF B could be considered "taking".
Action Specific	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	40 CFR 300	National oil and hazardous substances pollution contingency plan	Regulations setting forth the procedures for reporting, responsibilities, and planning actions to remediate releases. OSWER Directive 9355.3-01 is applicable.
	Superfund Amendments and Reauthorization Act (SARA)	40 CFR 355, 370, 372	Emergency planning and reporting	Pertains to hazardous and toxic chemical reporting and planning requirements.
	Fish and Wildlife Coordination Act	16 USC 661-666	Requires consultation when Federal department or agency proposes or authorizes any modification of any stream or other water body and adequate provision for protection of fish and wildlife resources.	This requirement would be applicable if modification of Farmers Branch Creek may be required. Consultation with the U.S. Fish and Wildlife Service and the appropriate state agency is required.
	Endangered Species Act	50 CFR 200, 402	Requires action to conserve endangered species within critical habitats upon which endangered species depend; includes consultation with Department of Interior.	This requirement would be most applicable to bird and fish species found in Farmers Branch Creek ecosystems. Consultation with Federal and state agencies can be accomplished simultaneously with requirements under the Fish and Wildlife Coordination Act.

Table B.1 (continued)
Preliminary Identified ARARs
NAS Fort Worth JRB, Texas

ARAR Category	Federal Act	Regulation/ Standard/Code	Description	Comments
Action Specific (continued)	Clean Water Act (CWA)	33 CFR 322	Structures or work within navigable waters of the United States	May be applicable to Farmers Branch Creek.
		33 CFR 323 33 CFR 328 33 CFR 329	Discharges of dredge or fill material to waters of the . United States	May be applicable to Farmers Branch Creek.
		40 CFR 109	Criteria for state, local, and regional oil removal contingency plans	Applicable if oil may be managed or used during remediation due to proximity to Farmers Branch Creek.
		40 CFR 110	Oil discharge	May be applicable if determined that oil has contaminated or may contaminate adjacent water bodies.
		40 CFR 112	Oil pollution prevention	Applicable to prevent oil spills into adjacent water bodies. Requires that persons who may discharge oil in harmful quantities must prepare a Spill Prevention Control and Countermeasure (SPCC) plan (40 CFR 112.1, [b]).
		Texas Administrative Code (TAC), Title 31, Chapter 343	Oil and hazardous substances	Provides for immediate cleanup of hazardous substances without obtaining a permit (Texas Water Code, Chapter 26).
		Texas Water Code, Title 2, Chapter 26, Subchapter G	Oil and hazardous substances spill prevention and control	Also known as Texas Hazardous Substances Spill Prevention and Control Act. Establishes policy to prevent the spill or discharge of hazardous substances into waters of the state of Texas.

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Table B.1 (continued)
Preliminary Identified ARARs
NAS Fort Worth JRB, Texas

ARAR Category	* Federal Act	Regulation/ Standard/Code	Description Control of the Control o	Comments
Action Specific (continued)	CWA (continued)	Texas Water Code, Title 2, Chapter 26, Subchapter I	Underground and aboveground storage tanks	Refers to state of Texas Solid Waste Law as related to water quality.
		Natural Resources Code, Title 2, Subtitle 6, Chapter 40	Texas Oil Spill Prevention and Response Act	Established policy for protection of all waters of the state, but focuses on coastal waters.
		TAC, Title 31, Chapter 55	Pollution/fish kill investigations	May be applicable if a fish kill is suspected or confirmed as a result of the release of hazardous substances.
		TAC, Title 31, Chapter 343	Texas oil and hazardous substances regulations	Implements regulations under the Texas Water Code (TWC), Chapter 26, Subchapter G.
		40 CFR 122	Natural Pollutant Discharge Elimination System (NPDES) program	Requires permits for the discharge of pollutants from a point source into waters of the United States.
		40 CFR 125	Criteria and standards for the NPDES	Includes effluent discharge and stormwater discharge.
		TAC, Title 31, Part IX, Chapter 305	Texas consolidated NPDES permit rules	Set standards and requirements for applications, permits, and actions by the Texas Water Commission.
		TAC, Title 31, Part IX, Chapter 315	Texas criteria and standards for the NPDES; pretreatment regulations	May be applicable depending on selected alternative.

Table B.1 (continued)
Preliminary Identified ARARs
NAS Fort Worth JRB, Texas

ARAR Category	· Federal Act	Regulation/ Standard/Code	Description	Comments
Action Specific (continued)	CWA (continued)	TAC, Title 31, Part IX, Chapter 319	General regulations incorporated into permit	Established allowable concentrations of hazardous metals to inland waters. Includes toxic pollutant quality control (319.26) and groundwater protection (319.27).
		TAC, Title 31, Part IX, Chapter 323	Waste disposal approvals	Applies to the collection of waste in floodplains, and groundwater protection requirements.
		TAC, Title 31, Chapter 331	Underground injection control	Applies to the injection of chemicals into non-potable aquifers to facilitate remediation.
	Hazardous Materials Transportation Act	49 CFR 107	Hazardous materials program procedures	
	(HMIA)	49 CFR 171, 172, 173, 174, 1 <i>7</i> 7	Hazardous materials regulations	Includes general information communication requirements, emergency response information, and carriage by rail and public highway. Carriage by vessel or arreraft is not anticipated.
	Resource Conservation and Recovery Act (RCRA)	40 CFR 241	Land disposal of solid waste	May be applicable to four SWMUs if excavation is required.
		40 CFR 256	State solid waste management plans	May be applicable if excavation of the four SWMUs reclassifies the sites as an "open dump".

Table B.1 (continued)
Preliminary Identified ARARs
NAS Fort Worth JRB, Texas

ARAR Category	Federal Act	Regulation/ Standard/Code	Description	Comments Comments
Action Specific (continued)	RCRA (continued)	40 CFR 257	Classification of disposal facilities and practices	May be applicable to the four SWMUs if determined that they pose an adverse environmental or health risk.
		40 CFR 260	Identification and listing of hazardous wastes	Identifies solid waste subject to regulations as hazardous waste.
		40 CFR 262	Hazardous waste generator standards	Waste will be generated as a result of remediation.
		40 CFR 263	Hazardous waste transportation standards	Waste will be transported, including samples, as a result of remediation. Manifests are required
		40 CFR 264	Standards for treatment, storage, and disposal (TSD) facilities	Waste may be stored on-site during remediation.
		40 CFR 265	Interim status standards	May be applicable if CAFB is required to be a RCRA permitted facility.
		40 CFR 266	Management of specific wastes	
		40 CFR 268	Land disposal restrictions (LDRs)	Identifies wastes restricted from land disposal unless specific exemptions exist. Applicable to several contaminants of concern.
		40 CFR 270	Hazardous waste permit program	May be applicable if CAFB is required to be a RCRA permitted facility.
		40 CFR 280	Underground storage tank regulations	Applies to owners/operators of underground storage tanks.

Table B.1 (continued)
Preliminary Identified ARARs
NAS Fort Worth JRB, Texas

ARAR Category	Federal Act	Regulation/ Standard/Code	Description	Comments
Action Specific (continued)	RCRA (continued)	Texas Solid Waste Disposal Act	Texas civil statutes Public Artícle 4477-7	Includes implementation of the Federal Resource Conservation and Recovery Act.
		Texas Underground Storage Tanks Act	Texas water code, Title 2, Chapter 26	Includes underground and aboveground storage tanks. Aboveground tanks pertain only to petroleum products.
		TAC, Title 31, Part IX, Chapter 334	Underground Storage Tank Rules	Applicable to underground storage tanks storing hazardous or petroleum products, and aboveground storage tanks containing petroleum.
		TAC, Title 31, Part IX, Chapter 330	Solid waste management regulations	Includes regulation of both hazardous and non-hazardous waste; however, targets municipal solid waste disposal.
		TAC, Title 31, Chapter 335	Texas industrial waste management regulations	Regulates the management and control of municipal hazardous waste and industrial wastes. Includes generators, transporters, and owners/operators of TSD facilities.
,		TAC, Title 31, Chapter 330	Disposal of lead acid batteries	May be applicable if batteries are disposed in any of the four SWMUs.
	Occupational Safety and Health Act (OSHA)	29 CFR 1900	Implementation of OSHA	Address standard safety practices including personal protective equipment.
Chemical Specific	CWA	40 CFR 129	Toxic pollutant effluent standards	Applicable if any toxic pollutants listed at 129.4 (including PCBs) are discovered.
		TAC, Title 31, Chapter 314	Texas toxic pollutant effluent standards	Adopts 40 CFR 129, by reference.

Table B.1 (continued)
Preliminary Identified ARARs
NAS Fort Worth JRB, Texas

ARAR	Federal Act	Regulation/ Standard/Code	Description	Comments
Chemical Specific	CWA (continued)	40 CFR 130	Water quality planning and management	Water quality planning, management, and program implementation.
(continued)		40 CFR 131	Water quality standards	Procedures for development, review, and approval of state water quality standards.
		TAC, Title 31, Chapter 307	Texas surface water quality standards	Standards of the state to maintain the quality water consistent with public health and enjoyment.
		TAC, Title 31, Chapter 311	Watershed protection	Includes Lake Worth regarding wastewater disposal and effluent requirements.
	Safe Drinking Water Act (SDWA)	40 CFR 141, 143	National primary and secondary drinking water standards	Establishes maximum contaminant levels (MCLs) for organics, inorganics, radioactivity, and turbidity. The standards also serve as groundwater cleanup standards at RCRA sites. Trichloroethene is the primary contaminants of concern
		TAC, Title 31, Part IX, Chapter 290	Texas drinking water standards	Essentially adopts 40 CFR 141, 143, and establishes standards for bacteriological, chemical, and radiological quality.
	Clean Air Act (CAA)	40 CFR 50	National primary and secondary ambient air quality standards	Establishes standards for sulfur oxides, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead.
		40 CFR 52 Subpart 55	Texas state implementation plan	Incorporates and cites revisions to Texas' 1972 original submittal of a state implementation plan.

Table B.1 (continued)
Preliminary Identified ARARs
NAS Fort Worth JRB, Texas

Comments	Includes dust, smoke, particulate matter, fumes, gas, vapor, odor produced by processes other than natural.	Implements the Texas CAA.	Requires that air pollutants can not be discharged that may be adverse to, or may be injurious to humans, animals, vegetation, and property.	Compliance with National Standards	Includes incineration of hazardous waste.	Dust control required for land clearing, construction, etc., if more than one area.	Possible applicable due to trichloroethane.	a.k.a. "Texas Regulation V"; regulates synthetic organic chemicals including henzene methylene chloride and vind	chloride which are contaminants of
Description	Abatement of air pollution and contaminants	Texas Air Pollution control regulations: General Provisions	Section 101.4 Nuisance	Section 101.20 and 101.21	Visible emissions and particulate matter	Section 111.145	National Emission Standards for Hazardous Air Pollutants (NESHAPS)	Control of air pollution for volatile organic compounds	
Regulation/ Standard/Code	Texas CAA	TAC, Title 31, Part III, Chapter 101			TAC, Title 31, Part III, Chapter 111		40 CFR 61	TAC, Title 31, Part III, Chapter 115	
Federal Act	CAA (continued)								
ARAR Category	Chemical Specific (continued)								

Table B.1 (continued)
Preliminary Identified ARARs
NAS Fort Worth JRB, Texas

ARAR Category	Federal Act	ļ , , , i	Description	Regulation/ Standard/Code
Chemical Specific (continued)	CAA (continued)	TAC, Title 31, Part III, Chapter 120	TAC, Title 31, Part III, Control of air pollution from Chapter 120 sites	Applies to all hazardous waste facilities required to obtain a permit pursuant to the Texas Solid Waste Disposal Act.
	Toxic Substances Control	40 CFR 761	Regulation of PCBs	Applicable if PCBs discovered.
	Act (TSCA)	40 CFR 763	Regulation of Asbestos	Applicable if asbestos containing materials are included in remediation.

Source: Rust Geotech, 1995

## TAB

Appendix C

#### APPENDIX C

SUMMARY OF BACKGROUND VALUES (JACOBS, 1998)

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Table C.1
Summary of Background Values for Surface Soil
NAS Fort Worth JRB, Texas

	1 6										
Analyte	detects	Defects/ Total	W (crit)	W (log)	W (raw)	Min	Max	Mean	Standard Deviation	UIL	Outlier?
Aluminum	0.0%	30 / 30	0.927	0.896 Accept	0.960 Accept	1790	19900	10775	5072	22035	No No
Antimony	80.08	6/30		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		<0.215	0.56	nc	nc	0.56	
Arsenic	0.0%	30 / 30	0.927	0.851 Reject	0.959 Accept	1.23	5.88	3.504	1.059	5 855	% N
Barium	0.0%	30 / 30	0.927	0.810 Reject	0.281 Reject	24.9	1980	145.3	349.3	233.0	Yes
Beryllium	0.0%	30 / 30	0.927	0.808 Reject	0.911 Reject	0.164	1.02	0.6552	0.2432	1.0200	No
Calcium	0.0%	30 / 30	0.927	0.969 Accept	0.687 Reject	418	111000	20991	28270	167788	No
Cadmium	6.7%	28 / 30	0.927	0.928 Accept	0.809 Reject	0.054	0.625	0.2118	0.1119	0.5562	No
Chromium	0.0%	30 / 30	0.927	0.952 Accept	0.965 Accept	5.06	20.1	11.73	4.203	21 056	No
Cobalt	0.0%	30 / 30	0.927	0.961 Accept	0.953 Accept	1.54	10.2	4.751	1.851	11.050	No
Copper	0.0%	30 / 30	0.927	0.909 Reject	0.964 Accept	4.44	16.7	10.77	2.974	17.373	No
Iron	0.0%	30 / 30	0.927	0.879 Reject	0.946 Accept	3460	15500	10199	3386	17717	No
Lead	0.0%	30 / 30	0.927	0.927 Reject	0.750 Reject	80.9	40.5	14.59	6.628	30.97	Yes
Magnesium	%0.0	30 / 30	0.927	0.830 Reject	0.968 Accept	112	2830	1369	736	3003	ž
Manganese	0.0%	30 / 30	0.927	0.923 Reject	0.624 Reject	132	1420	336.8	237.9	849.1	Yes
Mercury	93.3%	2 / 30	-	****		< 0.031	0.14	nc	nc	0.14	
Molybdenum	80.08	06/30	-			<0.657	1.460	nc	nc	1.460	
Nickel	0.0%	30 / 30	0.927	0.856 Reject	0.918 Reject	3.74	14.6	9.746	3.276	14.6	2
Potassium	%0.0	30 / 30	0.927	0.963 Accept	0.950 Accept	434	2790	1253	489.1	2895	No
Selenium	40.0%	18 / 30	0.927	0 857 Reject	0.840 Reject	0.059	0.637	0 212	0.1606	0 9072	2 2
Silver	33%	29 / 30	0.927	0.918 Reject	0.821 Reject	<0.025	0.213	0.0701	0.0352	0 213	ž

Summary of Background Values for Surface Soil NAS Fort Worth JRB, Texas Table C.1 (continued)

Analyte	% Non-	% Non- Detects/	W (crit)	W (crit) W (log)	W.(raw)	. Min	Max	i. Mean	Standard Standard Deviation UTL 98	UTL 95,98	Outlier?
Sodium	3.3%	29 / 30		ب ا	0.467 Reject	<2.57	37300	3482	8804	25800	Yes
Thallium	26 7 26		0.927	0,683 Reject	0.857 Reject	0.555	107	35.54	24.89	63.9	Yes
Vanadium	%00	30 / 30	1	0.884 Reject	0.966 Accept	5 82	48.5	23.89	10.08	46.26	No
y aniacium	20.0	06/06	0 927	0 927 0.819 Reject	0.488 Reject	13.3	124	29.30	18.96	38.8	Yes
Z.III.C.	0.0	20.00									

All units are in milligrams per kilogram (mg/kg).

not applicable

not calculated nc ND UTL,95,95 Ojulier?

Upper Tolerance Level (95% confidence and 95% coverage) not detected

Result of test to determine if the maximum value is a potential outlier.

Shapiro-Wilk critical value

calculated W using log-transformed data and result when compared to W (crit) calculated W using raw data and result when compared to W (crit)

Source: Final Basewide Background Summary (Jacobs, 1998) W (crit) W (log) W (raw)

Table C.2
Summary of Background Values for Subsurface Soil
NAS Fort Worth JRB, Texas

Analyte	% Non- detects	Detects/	W (crit)	W (log)	W (raw)	Min	Max	Mean	Standard Deviation	UTL	Outlier?
Aluminum	0.0%	30 / 30	0.927	0.960 Accept	0.955 Accept	3780	17700	9905	3277	17180	No
Antimony	80.0%	6 / 30	0.927			<0.21	0.712	nc	ПС	0.712	•
Arsenic	0.0%	30 / 30	0.927	0.963 Accept	0.942 Accept	1.42	5.31	3.0317	1.1266	5.533	No
Barium	0.0%	30/30	0.927	0.922 Reject	0.974 Accept	16.4	127	65.83	28.03	128.1	No
Beryllium	0.0%	30 / 30	0.927	0.966 Accept	0.969 Accept	0.208	1.07	0.5629	0.1776	0.957	No
Calcium	0.0%	30 / 30	0.927	0.733 Reject	0.853 Reject	751	347000	91395	76216	272000	Yes
Cadmium	33.3%	20 / 30	0.927	0.829 Reject	0.390 Reject	0.055	1.48	0.1754	0.2540	0.5891	Yes
Chromium	0.0%	30 / 30	0.927	0.937 Accept	0.847 Reject	5.77	17.90	9.494	2.766	16.31	No
Cobalt	10 0%	27 / 30	0.927	0.762 Reject	0.954 Accept	0.4395	5.5	3.181	1.356	6.191	No
Copper	0.0%	30 / 30	0.927	0.848 Reject	0.952 Accept	2.61	13.30	8.119	2.524	13.72	No
Iron	0.0%	30 / 30	0.927	0.936 Accept	0.941 Accept	3840	16900	9185	2720	15224	No
Lead	6.7%	28 / 30	0.927	0.746 Reject	0.949 Accept	0.073	14.3	5.280	3.325	12.66	No
Magnesium	0.0%	30 / 30	0.927	0.697 Reject	0.843 Reject	292	2420	1569	582.1	2420	No
Manganese	0.0%	30 / 30	0.927	0.904 Reject	0.964 Accept	28.7	317	169.6	82 03	351.7	No
Mercury	100.0%	0 / 30	0.927			< 0.03	< 0.035	DI.	nc	ND at 0.035	
Molybdenum	80.0%	6/30	0.927			<0.638	1.930	nc	nc	1.930	-
Nickel	0.0%	30 / 30	0.927	0.959 Accept	0.837 Reject	4.17	22.1	9.166	3.862	19.76	iā
Potassium	0.0%	30 / 30	0.927	0.909 Reject	0.977 Accept	271	1900	1000	322.8	1717	°Z
Selenium	80.0%	6/30	0.927	-		< 0.12	0.3130	ЭĽ	ЭC	0.3130	122
Silver	33.3%	20 / 20	0.927	0.862 Reject	0.847 Reject	<0.021	0.0928	0.0354	0.0273	0.1277	No

Summary of Background Values for Subsurface Soil NAS Fort Worth JRB, Texas Table C.2 (continued)

Analyte	% Non-	% Non-   Detects/	W (crit)	W (crit) W (log)	W (raw)	Min	Max	Mean	Standard Deviation	SUTL 98,98 C Outlier?	Outlier?
Sodium	10.0%		0.927	,	0.426 Reject	1.1	53200	4225	11762	53200	No No
Thallium	13.3%	26 / 30	0.927	0.630 Reject	0.858 Reject	0.575	65.4	34.74	19.84	65.4	No
Varadium	%00	30 / 30	0.927	0.980 Accept	0.926 Reject	7.6	37.8	20.33	6.245	37.39	No
7 inc	2000	1		0.851 Reject	0.963 Accept	5.9	31	18.70	5.663	31.27	No
ZIIIC	0.0		_11								

All units are in milligrams per kilogram (mg/kg).

not applicable

not calculated nc ND UTL<sub>95,95</sub> Outlier?

not detected

Upper Tolerance Level (95% confidence and 95% coverage)

Result of test to determine if the maximum value is a potential outlier.

Shapiro-Wilk critical value

calculated W using log-transformed data and result when compared to W (crit) calculated W using raw data and result when compared to W (crit)

Ŵ (crit) W (log) W (raw)

Source: Final Basewide Background Summary (Jacobs, 1998)

Table C.3
Summary of Background Values for Low-Stress Groundwater Samples
NAS Fort Worth JRB, Texas

	% Non-	Detects/		, , ,	-		· t		Standard		
Analyte	detects	A Total	W (crit)	e, W (log)	· W (raw)	· . Min 🐇	· Max	Mean	Deviation	: UTL 95,95	Outlier?
Aluminum	25.0%	9 / 12	0.859	0.930 Accept	0.505 Reject	0.052	0.472	0.0754	0.1910	1.332	N <sub>o</sub>
Antimony	100.0%	0 / 12	0.859		*****	<0.002	<0.002	υc	bic	ND at 0.002	
Arsenic	100.0%	0 / 12	0.859			< 0.0049	< 0.0049	nc	nc	ND at 0.0049	1
Barium	0.0%	12 / 12	0 859	0.887 Accept	0.647 Reject	0.052	0.472	0.135	0.114	0.587	Yes
Beryllıum	91.7%	1 / 12	0.859			<0.0003	0 0003	110	nc	0.0003	1
Calcium	0.0%	12 / 12	0.859	0.855 Reject	0.905 Accept	56.5	193	141.7	45.5	266 3	No
Cadmium	100.0%	0 / 12	0.859			<0.0005	< 0.0005	21	nc	ND at 0.0005	
Chromium	91.7%	1 / 12	0.859		-	< 0.0053	0.0064	ПС	nc	0.006	
Cobalt	100.0%	0 / 12	0.859			<0.0089	< 0.0089	)LC	nc	ND at 0.0089	
Copper	91.7%	1 / 12	0.859			<0.0008	0.0028	ПС	nc	0.0028	
lron	0.0%	12 / 12	0.859	0.874 Accept	0.872 Accept	0.0049	0.072	0.0253	0.0194	0.2239	No
Lead	100.0%	0 / 12	0.859	****		< 0.0016	<0.0016	nc	ЭU	ND at 0.0016	
Magnesium	0.0%	12 / 12	0.859	0.839 Reject	0.639 Reject	2.76	37.8	10.32	10.49	37.80	No
Manganese	0.0%	12 / 12	0.859	0.820 Reject	0.376 Reject	0.0019	2.86	0.2713	0.8177	0.175	Yes
Mercury	100.0%	0 / 12	0.859			< 0.0001	<0.0001	ПС	nc	ND at 0.0001	1
Molybdenum	100.0%	0 / 12	0.859			< 0.0144	<0.0144	nc	nc	ND at 0.0144	
Nickel	75.0%	3 / 12	0.859	-		< 0.002	0.0204	nc	uc	0.0204	
Potassium	33.3%	8 / 12	0.859	0.890 Accept	0.665 Reject	0.233	5.55	1.277	2.079	15.03	No
Selenium	25.0%	9 / 12	0.859	0.823 Reject	0.882 Accept	0.00055	0.0046	0.0021	0.0012	0.0077	No
Silver	91.7%	1 / 12	0.859		****	<0.0002	0.0002	nc	nc	0 0002	

Summary of Background Values for Low-Stress Groundwater Samples NAS Fort Worth JRB, Texas Table C.3 (continued)

Andread Total W (orit) W (not)	% Non-	% Non- Detects/	W (cmit)	W (no)	W (raw)	, J	Max	Mean	Standard Deviation	Standard Control Deviation CUTL 26.96 Ou	Outlier?
Sodium	0.0%	12 / 12	0.859	ᅵᆴ		6.17	144	28.76	37.05	167.2	Yes
	100.0%	+	0.859			<0.0632	<0.0632	nc	nc	ND at 0.0632	
<del>                                     </del>	18.2%	9 / 11	0.859	0.859 0.893 Accept	0.863 Accept	< 0.0029	0.0074	0.0034	0.0018	0.0123	No
	36.4% 7/11	7/11	0.859	0.859 0.877 Accept	0.622 Reject	0.00195	0.0487	0.0101	0.0170	0.1180	No

All units are in milligrams per liter (mg/L).

not applicable

not calculated

not detected ND UTL95.95 Outlier? W (crit) W (log)

Upper Tolerance Level (95% confidence and 95% coverage)

Result of test to determine if the maximum value is a potential outlier.

Shapiro-Wilk critical value

calculated W using log-transformed data and result when compared to W (crit) calculated W using raw data and result when compared to W (crit)

Source: Final Basewide Background Summary (Jacobs, 1998)

Table C.4
Summary of Background Values for Unfiltered Groundwater Samples
NAS Fort Worth JRB, Texas

Analyte	% Non-detects	Detects/ Total	W (crit)	W (log)	W (raw)	Min	Max	Mean 🔄	Standard Deviation	OTL	Outlier?
Aluminum	0.0%	12 / 12	0.859	0.950 Accept	0.779 Reject	0.0699	2.45	0.8072	0.8586	11.07	No
Antimony	91.7%	1 / 12	0.859			<0.002	0.0024	nc	nc	0 0024	
Arsenic	91.7%	1 / 12	0.859		1 2 2	<0.0049	0.0067	пс	nc	2900 0	
Barium	0.0%	12 / 12	0.859	0.982 Accept	0.882 Accept	0.0358	0.513	0.1931	0.1362	1.133	N <sub>o</sub>
Beryllium	66.7%	4 / 12	0.859		****	<0.003	0.0019	nc	пс	0.0019	
Calcium	0.0%	12 / 12	0.859	0.916 Accept	0.806 Reject	102	881	406.6	300.8	2438	No
Cadmium	66.7%	4 / 12	0.859			<0.0005	0.0016	51	nc	0.0016	
Chromium	58.3%	5 / 12	0.859			<0.0053	0.0136	20	nc	0.0136	
Cobalt	91.7%	1/12	0.859			<0.0089	0.01	22	nc	0.01	
Copper	50.0%	6 / 12	0.859	*****	-	<0.0008	0.0101	5	nc	0.0101	
Iron	0.0%	12 / 12	0.859	0.984 Accept	0.828 Reject	0.0768	2.64	0.7838	0.7026	7.234	2
Lead	100.0%	0/12	0.859			<0.0016	<0.0016	nc nc	nc	ND at 0.0016	
Magnesium	0.0%	12 / 12	0.859	0.905 Accept	0.735 Reject	3.79	35.6	11.91	10.65	68.78	No
Manganese	0.0%	12 / 12	0.859	0.958 Accept	0.863 Accept	0.0393	2.17	0.7055	0.6592	10.57	No
Mercury	100.0%	0 / 12	0.859			<0.0001	<0.0001	n Di	nc	ND at 0.0001	-
Molybdenum	100.0%	0/12	0.859			<0.0144	<0.0144	JI JI	nc	ND at 0.0144	
Nickel	%0.0	12 / 12	0.859	0.92 Accept	0.78 Reject	0.0022	0.0203	0.0068	0.0055	0.0364	No Sv
Potassium	\$0.0%	6/12	0.859			<0.466	3.9	20	nc Di	3.9	-
Selenium	16.7%	10 / 12	0.859	0.891 Accept	0.851 Reject	<0.0011	0.0042	0.0018	0.000	0.0072	20
Silver	91.7%	1 / 12	0.859			<0.0002	0.0003	nc	nc	0 0003	

Summary of Background Values for Unfiltered Groundwater Samples NAS Fort Worth JRB, Texas Table C.4 (continued)

	% Non-	% Non- Detects/	,	,	3.			*	Standard	Standard	
Analyte.	detects	. Total	W (crit)	Total : W (crit) W (log)	.W (raw)	Min	Max	Mean	Deviation	TTL 95,95	Outlier?
Sodium	0.0%	12 / 12	0.859	0.0% 12 / 12 0.859 0.960 Accept	0.630 Reject	1.96	91.5	20.24	23.68	176.2	No
Thallium	100.0%	0 / 12	0.859			<0.0632	<0.0632	nc	nc	ND at 0.0632	
Vanadium	9.1%	9.1% 10/11		0.943 Accept	0.859 0.943 Accept 0.920 Accept 0.00145	0.00145	0.0247	0.0093	0.0066	0.0653	No
Zinc	9.1%	9.1% 10 / 11		0.964 Accept	0.859 0.964 Accept 0 874 Accept	0.00195	0.0307	0.0107	0.0082	0.0682	No

All units are in milligrams per kilogram (mg/kg).

not applicable

not calculated nc ND UTL<sub>95,95</sub> Qutlier?

not detected

Upper Tolerance Level (95% confidence and 95% coverage)

Result of test to determine if the maximum value is a potential outlier.

Shapiro-Wilk critical value W (crit) W (log)

calculated W using log-transformed data and result when compared to W (crit) calculated W using raw data and result when compared to W (crit)

W (raw) = calculated W using raw data and result when Source: Final Basewide Background Summary (Jacobs, 1998)

Table C.5
Summary of Background Values for Surface Water
NAS Fort Worth JRB, Texas

Analyte         de           Aluminum         0           Antimony         75           Arsenic         100           Barium         0	detects										
m k		Total	W (crit)	W (log)	- W (raw)	Min	Max	Mean 3	Standard Deviation	UTL	Outlier?
<u>Ş</u>	0.0%	8/8	0.818	0.848 Accept	0.729 Reject	0.0509	0.178	0.0842	0.0410	0.2716	Yes
	75.0%	2/8	0.818			<0.002	0.0031	nc	nc	0.0031	
	100.0%	8/0	0.818			< 0.0049	< 0.0049	nc	ПС	ND at 0.0049	
	0.0%	8/8	0.818	0.957 Accept	0.928 Accept	0.0759	0.124	0.0953	0.0146	0.151	Š.
Beryllium 100	100.0%	8/0	0.818	1	****	< 0.0003	< 0.0003	21	22	ND at 0.0003	
Calcium 0.	0.0%	8/8	0.818	0.908 Accept	0.879 Accept	84.1	118	96.01	10.61	133.7	No
Cadmium 87,	87.5%	1 / 8	0.818	-		<0.0005	0.0005	nc	nc	ND at 0.0005	
Chromium 62.	62.5%	3 / 8	0 818			<0.0053	0.0078	пс	nc	0.0078	
Cobalt 100	100.0%	8/0	0.818			< 0.0089	<0.0089	nc	nc	ND at 0 0089	
Copper 25.	25.0%	8/9	0.818	0.566 Reject	0.566 Reject	<0.0004	0.0101	0.0077	0.0045	0.0101	No
Iron 0.0	0.0%	8/8	0.818	0.930 Accept	0.989 Accept	0.0221	0.223	0.1128	0.0633	0.9208	No
Lead 100	100.0%	8/0	0 818			<0.0016	< 0.0016	ПС	nc	ND at 0.0016	
Magnesium 0.0	0.0%	8/8	0.818	0.993 Accept	0.976 Accept	2.07	5.52	3.58	1.114	9.353	No.
Manganese 0.0	0.0%	8/8	0 818	0.937 Accept	0.864 Accept	0.0038	0.0716	0.0251	0.0218	0.4193	No
Mercury 87.	87.5%	1/8	0.818		-	< 0.0001	0.0001	nc	DG.	0.0001	
Molybdenum 100	100 0%	8/0	0.818			< 0.0144	<0.0144	22	20	ND at 0.0144	
Nickel 87	87.5%	1/8	0.818			< 0.002	0.0178	110	DI.	0.0178	
Potassium 0.0%	%	8/8	0.818	0.893 Accept	0.924 Accept	2.06	3.93	3.001	0.6836	6.347	Š
Selenium 25.0%	%0	8/9	0.818	0.689 Reject	0.779 Reject	0.00055	0.0025	0.0018	0.0000	0.0115	2
Silver 75.0%	%0	2/8	0.818			< 0.0002	0.0003	)L	21	0.0003	

Summary of Background Values for Surface Water NAS Fort Worth JRB, Texas Table C.5 (continued)

Analyte	% Non- Detects/	Detects/ Total	W (crit)	W (crit) W (log)	W (raw)	Min v Max	Max	Mean	Standard Deviation	Standard Deviation UTL 95,95 Outlier?	Outlier?
Sodium		8/8	0.818	0.959 Accept	0.959 Accept 0.943 Accept	19.3	32.9	25.74	4.752	45.46	No
Thallum	100.0%	•	0.818			<0.0632	<0.0632 <0.0632	nc	nc	ND at 0.0632	
Vanadium	25.0%		0.818	0.882 Accept	0.882 Accept 0.941 Accept	<0.0029	0.0058	nc	nc	0.0159	
Zinc	75.0%		2 / 8 0.818	1		<0.0039	0.0122	nc	nc	0.0122	Š

All units are in milligrams per liter (mg/L).

not applicable

not calculated nc ND UTL95,95 Outlier?

Upper Tolerance Level (95% confidence and 95% coverage) not detected

Result of test to determine if the maximum value is a potential outlier. Shapiro-Wilk critical value

W (crit) = Shapiro-Wilk critical value
W (log) = calculated W using log-transformed data and result when compared to W (crit)
W (raw) = calculated W using raw data and result when compared to W (crit)
Source: Final Basewide Background Summary (Jacobs, 1998)

Table C.6
Summary of Background Values for Stream Sediment Samples
NAS Fort Worth JRB, Texas

Analyte	% Non-	Detects/	W (crit)	W (log)	W (raw)	Z.	Max	Mean	Standard		Outlier?
Alumimum	0.0%	8/8	0.818	0.892 Accept	0.924 Accept	2280	9240	5540	2679	28767	No
Antimony	87.5%	1/8	0.818			<0.244	0.33	ານຕ	nc	0.33	
Arsenic	0.0%	8/8	0 818	0.951 Accept	0.925 Accept	2.85	5.27	3.7488	0.7848	0 7018	No
Barium	0.0%	8/8	0.818	0.920 Accept	0.918 Accept	21.9	76.8	48.03	09:61	180.4	No
Beryllium	0.0%	8/8	0 818	0.912 Accept	0.912 Accept	0.194	0.557	0.3734	0.1336	1.189	No
Calcium	0.0%	8/8	0.818	0.877 Accept	0.928 Accept	75100	189000	139888	35825	337544	No
Cadmium	0.0%	8/8	0 818	0.859 Accept	0.866 Accept	0.152	0.292	0.2164	0.0588	0.5071	No
Chromium	0.0%	8/8	0.818	0.869 Accept	0.885 Accept	4.81	9.59	7.546	1.840	17.0	No
Cobalt	0.0%	8/8	0.818	0.882 Accept	0.872 Accept	1.59	3.43	2.51	0.7757	6.651	No
Copper	0.0%	8/8	0.818	0.961 Accept	0.953 Accept	4.28	11.7	7 428	2.627	22.18	No
Iron	0.0%	8/8	0.818	0.807 Reject	0.832 Accept	5030	0808	6923	1184	10696	No
Lead	0.0%	8/8	0.818	0.956 Accept	0.818 Reject	2.21	26.9	9.1	8.330	104.1	No
Magnesium	0.0%	8/8	0.818	0.912 Accept	0.938 Accept	1450	2140	1876	221.7	2772	No
Manganese	%0.0	8/8	0.818	0.840 Accept	0.743 Reject	143	362	198.4	71.16	491.3	Yes
Mercury	87.5%	1/8	0.818	****		<0.037	0.0360	nc	nc	0.0360	
Molybdenum	12.5%	2/8	0.818	0.894 Accept	0.963 Accept	0.4355	2.68	1.659	0.7692	9.693	No
Nickel	%0.0	8/8	0.818	0.937 Accept	0.958 Accept	5.55	12	9 0475	2.147	19.76	No
Potassium	0.0%	8/8	0.818	0.904 Accept	0.929 Accept	386	1300	788.4	340	3227	No
Selenium	87.5%	1/8	0.818		****	<0.134	0.214	nc	пС	0.214	<u>30</u>
Silver	%00	8/8	0.818	0.965 Accept	0.888 Accept	0.0311	0.0929	0.0532	0.0188	0.144	2

639 430

Summary of Background Values for Stream Sediment Samples NAS Fort Worth JRB, Texas Table C.6 (continued)

Analyte	% Non- detects	Detects/ Total	% Non- Detects/ Address Total W (crit).	W (log)	W (raw)	Tujų Si	Max	ĭ, ˙˙;̈́. Mean;∷̈́.	Standard Deviation UTL	, S	Outlier?
Sodium	75.0%	2/8	0.818			<2.44	6.07	nc	nc	6.07	
Thallium	0.0%	8/8	0.818	0.818 0.912 Accept 0.936 Accept	0.936 Accept	22.2	43.4	33.41	7.443	69.74	No
Vanadium	0.0%	8/8	0.818	0.818 0.902 Accept	0.896 Accept	15.4	24.1	19.26	3.206	32.26	No
Zinc	0.0%	8/8	0.818	0.818 0.971 Accept	0.853 Accept	11.3	53.9	25.48	13.11	101.3	No

Notes:

All units are in milligrams per kilogram (mg/kg).

not applicable

not calculated nc ND UTL95,95

not detected

Upper Tolerance Level (95% confidence and 95% coverage)

Result of test to determine if the maximum value is a potential outlier.

Shapiro-Wilk critical value

W (log) = calculated W using log-transformed data and result when compared to W (crit) W (raw) = calculated W using raw data and result when compared to W (crit) Source: Final Basewide Background Summary (Jacobs, 1998)

Outlier? W (crit) W (log) W (raw)

### TAB

Appendix D

#### APPENDIX D FIELD FORMS



#### **BORING LOG**

Borehole ID	
Sheet	of

										Loc	ation		
Proje	ect N	ame		_	-	Project Nu	mber	LTCCODE (IRPIMS)		Site	ID		LPRCODE (IRPIMS)
Dnll	ing C	Compa	ıny		_	Dnller	<u>-</u>	Ground Elevation		Tota	ıl Dril	led Depth	
Dnil	ing E	quipπ	nent		Drilling	Method	Borehole Diameter	Date/Time Drilling Started		Date	/Time	Total Depth Re	ached
Тур	e of S	Sampli	ing De	vice	<u>.                                    </u>		,	Water Level (bgs)		Fin	ıal		
Sami	ole H	amme	·r					Hydrogeologist				by/Date	-
Type					Driving	. W.	Drop					•	
		Descr	ntion	(include		ield logbook							
Loca	111011	Desci.	ipiion	(IIICIUUE	skettii iii i	ileiu logoook	••						
Depth	Interval	Recovery	Blow Counts					rity, Munsell color name & nsity, consistency, etc., as	USCS Symbol	Lithology	Water Content		Remarks  unple types & depth, odor,  or measurements, etc.)

#### HYDRO Geologic

#### WELL CONSTRUCTION DETAILS AND ABANDONMENT FORM

DRILLING CONTRACTOR.  AMOUNT OF FILTER PACK USED  TYPE OF BENTONITE  AMOUNT BENTONITE USED  TYPE OF GEMENT  TYPE OF GEMENT  TYPE OF GEMENT  AMOUNT CEMENT USED  BOREIOLE DIAMETER  AMOUNT CEMENT USED  WELL CONSTRUCTION START DATE: WELL CONSTRUCTION COMPLETE DATE  DIMENSIONS OF SECURITY CASING  SCREEN MATERIAL  SCREEN MATERIAL  CASING MATERIAL  CASING MATERIAL  CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAR  SPECIAL CONDITIONS (describe and draw)  WELL CAR  SCREEN DEPTH TO TOP OF BENTONITE SEAL  SCREEN  BEND CAP  DEPTH TO TOP OF SCREEN  NOT TO SCALE  INSTALLATION OBSERVED BY:	FIELD REPRESENTATIVE	<del></del>
DRILLING TECHNIQUE AUGER SIZE AND TYPE AMOUNT BENTONITE AMOUNT DENTONITE USED  TYPE OF CEMENT BOREHOLE DIAMETER AMOUNT CEMENT USED GROUT MATERIALS USED  WELL CONSTRUCTION START DATE: WELL CONSTRUCTION COMPLETE DATE  WELL CONSTRUCTION COMPLETE DATE  SCREEN MATERIAL  CASING MATERIAL  CASING MATERIAL  CASING MATERIAL  CASING MATERIAL  CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  TYPE OF END CAP  DEPTH TO TOP OF BENTONITE SEAL  SCREEN  LENGTH  SOCREEN  LENGTH  BOREHOLE DEPTH  NOT TO SCALE	DDU LING OONED ACTOR	GRADIATION
BOREHOLE IDENTIFICATION BOREHOLE DIAMETER WELL DENTIFICATION.  WELL CONSTRUCTION START DATE: WELL CONSTRUCTION COMPLETE DATE  DIMENSIONS OF SECURITY CASING  SCREEN MATERIAL SCREEN DIAMETER STRATUM-SCREENED INTERVAL (FT)  CASING MATERIAL. CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE DIMENTION OF CONCRETE PAD  GROUT BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  SORGEN  DEPTH TO TOP OF FILTER PACK  NOT TO SCALE	DRILLING CONTRACTOR,	AMOUNT OF FILTER PACK USED.
BOREHOLE IDENTIFICATION BOREHOLE DIAMETER WELL DENTIFICATION.  WELL CONSTRUCTION START DATE: WELL CONSTRUCTION COMPLETE DATE  DIMENSIONS OF SECURITY CASING  SCREEN MATERIAL SCREEN DIAMETER STRATUM-SCREENED INTERVAL (FT)  CASING MATERIAL. CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE DIMENTION OF CONCRETE PAD  GROUT BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  SORGEN  DEPTH TO TOP OF FILTER PACK  NOT TO SCALE	DDILLING TECUNIOLE	TYPE OF DENTONITE
BOREHOLE IDENTIFICATION BOREHOLE DIAMETER WELL DENTIFICATION.  WELL CONSTRUCTION START DATE: WELL CONSTRUCTION COMPLETE DATE  DIMENSIONS OF SECURITY CASING  SCREEN MATERIAL SCREEN DIAMETER STRATUM-SCREENED INTERVAL (FT)  CASING MATERIAL. CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE DIMENTION OF CONCRETE PAD  GROUT BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  SORGEN  DEPTH TO TOP OF FILTER PACK  NOT TO SCALE	AUGER SIZE AND TYPE	AMOUNT RENTONITE LISED
WELL CONSTRUCTION START DATE:  WELL CONSTRUCTION START DATE:  WELL CONSTRUCTION COMPLETE DATE  DIMENSIONS OF SECURITY CASING  SCREEN MATERIAL.  CASING MATERIAL.  CASING MATERIAL.  CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  BOREHOLE DEPTH TO TOP OF SCREEN  LENGTH  BOREHOLE DEPTH  NOT TO SCALE	AUGER SIZE AND THE	AMOUNT BENTONTE USED
WELL CONSTRUCTION START DATE:  WELL CONSTRUCTION START DATE:  WELL CONSTRUCTION COMPLETE DATE  DIMENSIONS OF SECURITY CASING  SCREEN MATERIAL.  CASING MATERIAL.  CASING MATERIAL.  CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  BOREHOLE DEPTH TO TOP OF SCREEN  LENGTH  BOREHOLE DEPTH  NOT TO SCALE	BOREHOLE IDENTIFICATION	TYPE OF CEMENT
WELL CONSTRUCTION START DATE: WELL CONSTRUCTION START DATE: WELL CONSTRUCTION COMPLETE DATE  DIMENSIONS OF SECURITY CASING  SCREEN MATERIAL. CASING MATERIAL. CASING MATERIAL. CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  SPECIAL CONDITIONS (describe and draw)  WELL CAP  GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE  DEPTH TO TOP OF BENTONITE SEAL  SCREEN  SCREEN  DEPTH TO TOP OF FILTER PACK  SCREEN  LENGTH  BOREHOLE DEPTH  NOT TO SCALE	BOREHOLE DIAMETER	AMOUNT CEMENT USED
WELL CONSTRUCTION START DATE:  WELL CONSTRUCTION COMPLETE DATE  DIMENSIONS OF SECURITY CASING  SCREEN MATERIAL.  CASING MATERIAL.  CASING MATERIAL.  CASING MATERIAL.  CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  BOREHOLE DEPTH TO TOP OF FLITER PACK  NOT TO SCALE	WELL IDENTIFICATION	GROUT MATERIALS USED
SCREEN MATERIAL  SCREEN DIAMETER  STRATUM-SCREENED INTERVAL (FT)  CASING MATERIAL.  CASING MATERIAL.  CASING MATERIAL.  CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  SCREEN  DEPTH TO TOP OF FILTER PACK  SAND CELLAR  SAND CELLAR  BOREHOLE DEPTH  NOT TO SCALE		
CASING MATERIAL.  CASING MATERIAL.  CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  SAND CELLAR  SAND CELLAR  BOREHOLE DEPTH TO TOP OF SCREEN  LENGTH  NOT TO SCALE	WELL CONSTRUCTION START DATE: WELL CONSTRUCTION COMPLETE DATE	DIMENSIONS OF SECURITY CASING
CASING MATERIAL.  CASING MATERIAL.  CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  SAND CELLAR  SAND CELLAR  SAND CELLAR  BOREHOLE DEPTH TO TOP OF SCREEN  LENGTH  NOT TO SCALE	CORCELLA TERIAL.	TABLE OF MICH CAR
CASING MATERIAL.  CASING MATERIAL.  CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  SAND CELLAR  SAND CELLAR  BEND CAP  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  LENGTH  BOREHOLE DEPTH  NOT TO SCALE	SCREEN MATERIAL'	TYPE OF END CAP
CASING MATERIAL.  CASING DIAMETER  SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE FAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  SAND CELLAR  SAND CELLAR  DEPTH TO TOP OF SCREEN  LENGTH  BOREHOLE DEPTH  NOT TO SCALE	SCREEN DIAMETER	I TPE OF END CAP
SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  SCREEN  LENGTH  SAND CELLAR  LENGTH  NOT TO SCALE	STRATUM-SCREENED INTERVAL (FT)	
SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  DEPTH TO TOP OF BENTONITE SEAL  SCREEN  LENGTH  SAND CELLAR  DEPTH TO TOP OF SCREEN  END CAP  DEPTH TO BASE OF WELL  BOREHOLE DEPTH  NOT TO SCALE	CASING MATERIAL	COMMEN 15.
SPECIAL CONDITIONS (describe and draw)  WELL CAP  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  SCREEN  LENGTH  SAND CELLAR  LENGTH  BOREHOLE DEPTH TO TOP OF SCREEN  NOT TO SCALE	CASING DIAMETED	<del>_</del>
SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  DEPTH TO TOP OF BENTONITE SEAL  SCREEN  LENGTH  SAND CELLAR  DEPTH TO TOP OF SCREEN  END CAP  DEPTH TO BASE OF WELL  NOT TO SCALE	CASING DIAMETER	<del>_</del>
SPECIAL CONDITIONS (describe and draw)  WELL CAP  SECURITY CASING  CASING LENGTH ABOVE GROUND SURFACE  DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  DEPTH TO TOP OF BENTONITE SEAL  SCREEN  LENGTH  SAND CELLAR  DEPTH TO TOP OF SCREEN  END CAP  DEPTH TO BASE OF WELL  NOT TO SCALE		
CASING LENGTH ABOVE GROUND SURFACE DIMENTION OF CONCRETE PAD GROUND SURFACE (REFERENCE POINT)  LEGEND GROUT BENTONITE SEAL FILTER PACK  DEPTH TO TOP OF BENTONITE SEAL  SCREEN LENGTH BOREHOLE DEPTH  NOT TO SCALE	Т	
CASING LENGTH ABOVE GROUND SURFACE DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  DEPTH TO TOP OF BENTONITE SEAL  SCREEN  LENGTH  BOPTH TO TOP OF SCREEN  END CAP  DEPTH TO TOP OF SCREEN  END CAP  DEPTH TO BASE OF WELL  NOT TO SCALE	WELL CAL	SECURITY CASING
DIMENTION OF CONCRETE PAD  GROUND SURFACE (REFERENCE POINT)  LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF FILTER PACK  SCREEN  LENGTH  END CAP  DEPTH TO BASE OF WELL  NOT TO SCALE	(describe and draw)	CASING LENGTH AROVE GROUND SURFACE
GROUND SURFACE (REFERENCE POINT)  LEGEND GROUT BENTONITE SEAL FILTER PACK  DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  SCREEN LENGTH END CAP DEPTH TO BASE OF WELL BOREHOLE DEPTH  NOT TO SCALE		1 1 1
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  LENGTH  END CAP  DEPTH TO BASE OF WELL  NOT TO SCALE		DIIVIENTION OF CONCRETE PAD
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  LENGTH  END CAP  DEPTH TO BASE OF WELL  NOT TO SCALE		GROUND SURFACE (REFERENCE POINT)
LEGEND  GROUT  BENTONITE SEAL  FILTER PACK  DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  BEND CAP  LENGTH  END CAP  DEPTH TO BASE OF WELL  NOT TO SCALE	i	
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  LENGTH  END CAP  DEPTH TO BASE OF WELL  NOT TO SCALE		<u></u>
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  LENGTH  END CAP  DEPTH TO BASE OF WELL  BOREHOLE DEPTH  NOT TO SCALE	1	LEGEND
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  DEPTH TO TOP OF SCREEN  END CAP  DEPTH TO BASE OF WELL  BOREHOLE DEPTH  NOT TO SCALE		
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  DEPTH TO TOP OF SCREEN  END CAP  DEPTH TO BASE OF WELL  BOREHOLE DEPTH  NOT TO SCALE		GROUT
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  LENGTH  END CAP  DEPTH TO BASE OF WELL  NOT TO SCALE		
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  END CAP  END CAP  DEPTH TO BASE OF WELL  BOREHOLE DEPTH  NOT TO SCALE		BENTONITE SEAL
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  END CAP  END CAP  DEPTH TO BASE OF WELL  BOREHOLE DEPTH  NOT TO SCALE	ļ	
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  END CAP  SAND CELLAR LENGTH  BOREHOLE DEPTH  NOT TO SCALE		FILTER PACK
DEPTH TO TOP OF BENTONITE SEAL  DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  END CAP  SAND CELLAR LENGTH  BOREHOLE DEPTH  NOT TO SCALE		
DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  LENGTH  END CAP  DEPTH TO BASE OF WELL  BOREHOLE DEPTH  NOT TO SCALE		
DEPTH TO TOP OF FILTER PACK  DEPTH TO TOP OF SCREEN  LENGTH  END CAP  DEPTH TO BASE OF WELL  BOREHOLE DEPTH  NOT TO SCALE		
SCREEN LENGTH  END CAP  SAND CELLAR LENGTH  BOREHOLE DEPTH  NOT TO SCALE		DEPTH TO TOP OF BENTONITE SEAL ————————————————————————————————————
SCREEN LENGTH  END CAP  SAND CELLAR LENGTH  BOREHOLE DEPTH  NOT TO SCALE		
SCREEN LENGTH  END CAP  SAND CELLAR LENGTH  BOREHOLE DEPTH  NOT TO SCALE		DEDTH TO TOD OF SIT TED NACE
SCREEN LENGTH  END CAP  SAND CELLAR LENGTH  BOREHOLE DEPTH  NOT TO SCALE		DEFIN TO TOP OF FILTER PACK
SCREEN LENGTH  END CAP  SAND CELLAR LENGTH  BOREHOLE DEPTH  NOT TO SCALE	[·	
SAND CELLAR LENGTH  BOREHOLE DEPTH  NOT TO SCALE		DEPTH TO TOP OF SCREEN
SAND CELLAR LENGTH  BOREHOLE DEPTH  NOT TO SCALE	[ ]*	<u>;  ;- </u>
SAND CELLAR LENGTH  BOREHOLE DEPTH  NOT TO SCALE	renoin———	
SAND CELLAR DEPTH TO BASE OF WELL BOREHOLE DEPTH—  NOT TO SCALE	<del></del>   [•	ENID CAP
BOREHOLE DEPTH	<u>_</u> '=-!	
BOREHOLE DEPTH		DEPTH TO BASE OF WELL
NOT TO SCALE	LENGTH	
	<del></del>	Potential PNI III
INSTALLED BY INSTALLATION OBSERVED BY:		NOT TO SCALE
ING TABLET DE LE	INSTALLED BY INST	TALL ATION ORSERVED BY:
	103	INDUSTRATION OBSERVED B1.
IIN REPAIN IES	DISCREPANCIES	<del></del>



#### WELL DEVELOPMENT RECORD

WELL/PIEZOME	TER ID
SHEET	of

PROJECT NAME		_PROJE	CT NO					DATI	E	_	
LOCATION		_ DATE	INSTALI	LED _						_	
TOTAL DEPTH (FTOC)		_CASI	IG DIAM	ETER_		-					
METHODS OF DEVELOPMEN	<u>IT</u>										
☐ Swabbing	☐ Bailing	;	☐ Pump	ong	☐ Des	cribe					
Equipment decomtaminated prior to d	ievelopme	nt			☐ Ye	s	□ NO				
Describe		_									
EQUIPMENT NUMBERS											
pH Moter	EC Meter	·			Turbidity M	eter		7	hermomet	er	
CASING VOLUME INFORMA	TION_										
Casing ID (inch)	10	15	20	2 2	3 0	40	4 3	5 0	60	70	80
Unit Casing Volume (A) (gal/ft)	0 04	0 09	0 16	02	0 37	0 65	0 75	10	1.5	20	26
PURGING INFORMATION  Measured Well Depth (B)  Measured Water Level Depth (C)  Length of Static Water Colume (D)  Casing Water Volume (E) +  (A)	(B)	(C)	ft				Н,	~   <del> </del>	C D		VATION TOC)

Date	Time	Water Level (FTOC)	Volume Removed (gal)	pН	EC	Temperature F or C	Turbidity/ Sand (ppm)	Comments
-								
			<u> </u>					
					_			



#### WASTE INVENTORY TRACKING FORM

LOCAT	TION :							
PROJE	CT NAME	£:						
ACTIV	ITIES:	_						_
Date Waste Generated	Activity Generating Waste (borehole # / well #)	Description of Waste	Field Evidence of Contamination	Estimated Volume	Type of Container (storage ID#)	Location of Container	Waste Characterization	Comments
				_				
_				-				
			<u>-</u>				-	
_								
		-						
_								
_	_	_						
				<u> </u>				
				_				
Note	Describe when	ther soil or v	water samples ha	ave been co	ollected for wa	ste character	rization, include o	late, if known.



#### DRO MONITOR WELL STATIC WATER LEVEL FORM

PROJECT NA	ME:			DATE:	
WATER LEV	EL IND	OICATOR ID#		FIELD BO	OOK #
LOCATION:		· · · · · · · · · · · · · · · · · · ·		PAGE#_	
Monitor Well Number	Time	Depth to Static Water Level (from T.O C.)	Total Well Depth (ft)	Explosimeter Reading (above background)	PID Reading (above background)
	! 				
202	<u>.                                    </u>	_			
_					
	_				
		_	<u> </u>		
Note. Total well	depth to t	pe measured at time	e of gauging.	<u> </u>	
			_		
				<del></del>	
Sampler			Obs	erver	



#### MONITOR WELL PURGING FORM

PRC	JECT ·				DA	ΓE			
LOC	CATION _				EXF	PLOSIMETER B	OREHOLE	READING	
						RGE VOLUME VELLBORE VO	LUMES): _		(gal)
ime	Depth to Water (ft)	Flow Meter Reading	Volume Purged (gal)	Temp. (°C)	рН	Specific Conductance (µmhos/cm)	Turbidity (NTU)	Dis Oxy. (mg/L)	Comments
				_					
:									
		<u> </u>						•	_
•					├—				
-		<u> </u>							
_									
	<u> </u>	-							
						-		<del> </del>	
		n of the well.	ore last reading	,					
Sa	mnler			1	Observ	ret			



#### FIELD SAMPLING REPORT

LOCATION:					F	PROJECT	_	
SITE·								
				MPLE INFO				
MA'TRIX					SA	MPLE ID		
SAMPLING	ME	THOD			DU	P./REP. OF		<u> </u>
BEGINNING	G DI	ЕРТН _			MA	ATRIX SPIKE/M YES ( )		PIKE DUPLICATE
END DEPTH	·					165()	NO	
								IME:
CONTAINE SIZE/TYPE						ANALYTICAL METHOD		ANALYSIS
			NC.	TABLE OF	SEI	RVATIONS		
	PID READINGS SAMPLE CH							MISCELLANEOUS
1st			COLOR					
2nd			ODOR OTHER	_				
							1	
				GENERAL II	NFO	RMATION		
WEAT	HER	· SUN/	CLEARO	VERCAST/RAIN	'	WIND DRIECT	юм	AMBIENT TEMP
SHIPM	ENT	VIA	FED-X	AND DELIVER	·	COURIER _	<del>_</del>	OTHER
SHIPPE	ED T	о						
сомм	EN1	rs			_			<u>-</u>
SAMPI	.ER					OBSERVER:		
_		MATRIX	TYPE CODES			SAMP	LING MET	HOD CODES
DC=DRILL CUTT WG=GROUND W LH=HAZARDOU SH=HAZARDOU SE=SEDIMENT	ATE S LIÇ	R (UID WAS		WATER	1	B=BAILER BR=BRASS RING CS=COMPOSITE SAM C=CONTINUOUS FLIG DT=DRIVEN TUBE W=SWAB\WIPE		G=GRAB HA=HAND AUGER H=HOLLOW STEM AUGER HP=HYDRO PUNCH SS=SPLIT SPOON SP=SUBMERSIBLE PUMP



## Daily Equipment Calibration Log

Comments Instrument Readings Calibration Solution or Gas Concentration Standard/ Manufacturer/Lots Instrument Make/ Model/Serial Calibrated by Project Name: \_\_\_ Project No.: Date/Time

HydroGeoLogic, Inc. 01/03/97

# CHAIN OF CUSTODYR ECORD

1155 Herndon Parkway	Surte 900	Herndon, VA 20170
		180000 18000000000000000000000000000000

Client			<b>.</b>		Ž	MATRIX						ANAL	YSIS	ANALYSIS REQUIRED	IRED		APPLICABLE
							8		Ì		/	/	\		\	_	REGULATION
Project Name/No.:							NEBS		\		\	\	\	\	\	\	□ RCRA
Project Manager:				T			<b>NIATIN</b>		\				\	\	_		
Sampler:		ļ		·			00 1		<u> </u>				\	\	\		□ NPDES
Phone: (703) 478-5186 Fax: (703) 471-4180	1-4180			31160	Ł		O 'ON -			\	\	\					SDWA
SAMPLE IDENTIFICATION	DATE	TIME	BARD	COME	WATE	i∃HTO	IATOT								REMARK	S OR SAME	REMARKS OR SAMPLE LOCATION
										<u> </u>							
			_														
Special Instructions																	
Possible Hazard Identification	Skin Irritant	☐ Poison B	n B		□ Unknown	DWI	S	Sample Disposal	sposal	B	turn to	☐ Return to Client		Dispose	☐ Disposal by Lab	☐ Archive for	or Months
Tum Around Time Required	□ Rush	႘	QC Level	ā		≡	፫	Project Specific (specify)	ecific (:	specif	<u>~</u>						
1 Relinquished by		Date	· m		Time		<b></b> -	1. Received by	d by	,						Date	Тіте
2. Relinquished by		Date	m	F	Time		2	2. Received by	d by							Date	Тіте
3. Relinquished by		Date		F	Tıme		3	Received by	d by							Date	Time
Comments																	

Project Name: \_\_\_\_\_\_



#### LOG OF DAILY TIME AND MATERIALS

_	Project Number: Subcontractor:
foring or Well No.:	Date:
ITEM	NO. UNITS
Drilling /ft	
inch augerhole	
inch mud rotary hole	
inch air rotary	
Split spoon samples	
Shelby tube samples	
rock coring	
Driven casinginch	
Well Materials	. 1
inch stainless steel riser pipe	
inch stainless steel screen	
inch PVC riser pipe	
inch PVC screen	
Couplings	
Bottom caps	
Top caps	
Protective casings w/ locking caps	
Well installation	
Revert (bags)	
Bentonite powder (bags)	
Bentonite pellets (buckets)	
Sand (bags)	
Cement (bags)	
Other Charges	
Standby	
Decontamination	
Well development	
Spoil disposal (barrels)	
Other:	
HydroGeoLogic Site Representative:	
Subcontractor Site Representative	

#### FINAL PAGE

#### **ADMINISTRATIVE RECORD**

FINAL PAGE